Reg. No. \_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov / Dec – 2019**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  |  |  |
| **Code :** | **16NT3014** | **Duration :** | **3hrs** |
| **Sub. Name :** | **MOLECULAR MACHINES AND SENSORS** | **Max. Marks :** | **100** |

**ANSWER ALL QUESTIONS (5 × 20 = 100 Marks)**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | Describe the molecular rotor-type action of ATP synthase. | CO1 | 3 |
| b. | Describe any one synthetic molecular motor and explain its function with a neat illustration. | CO2 | 14 |
| c. | Draw the structure of a porphyrin molecule. Give one or two of the structural novelty of porphyrins. | CO2 | 3 |
| **(OR)** | | | | |
| 2. | a. | Define nanobots with an example. | CO1 | 3 |
| b. | Why are molecules better for functioning as machines at the nanoscale? | CO2 | 3 |
| c. | Explain molecular ON–OFF switching with an example. | CO2 | 14 |
|  | | | | |
| 3. | a. | Briefly explain the structure of dendrimers. | CO2 | 3 |
| b. | Explain the conversion of triplet to singlet oxygen and the energy processes associated with the aid of an energy level diagram. | CO2 | 3 |
| c. | Explain working of light harvesting antennae. Illustrate the phenomenon with an illustration. | CO1 | 14 |
| **(OR)** | | | | |
| 4. | a. | Briefly explain a molecular junction. | CO3 | 3 |
| b. | What are molecular wires? | CO4 | 3 |
| c. | Give a detailed account of molecular shuttles. | CO4 | 14 |
|  | | | | |
| 5. | a. | What are single molecule devices? | CO3 | 5 |
| b. | Explain a voltage driven conductivity switch. | CO4 | 7 |
| c. | Explain the salient features of Drexler–Smalley debate. | CO5 | 8 |
| **(OR)** | | | | |
| 6. | a. | Draw the structure of a molecular logic gate and explain its logic operation. | CO4 | 3 |
| b. | Describe a molecular voltage-driven conductivity switch. | CO3 | 3 |
| c. | Describe the following with any one example:  (i) synthetic molecular shuttle. (ii) molecular tweezer.  Explain their function with neat illustrations. | CO3 | 14 |
|  | | | | |
| 7. | a. | Briefly explain a molecular information ratchet. | CO4 | 3 |
| b. | Explain the working of a molecular nanocar. | CO4 | 3 |
| c. | Explain: (i) molecular motion driven by STM.  (ii) cucurbituril based rotaxanes with suitable illustrations. | CO4 | 14 |
| **(OR)** | | | | |
| 8. | a. | Briefly explain a rotaxane based on cucurbiturils. | CO3 | 3 |
| b. | Briefly explain the working of a molecular memory device. | CO4 | 3 |
| c. | Explain threaded and interlocked compounds on surfaces with suitable diagrams. | CO4 | 14 |
|  | | **Compulsory:** |  |  |
| 9. | a. | Define selectivity in metal ion sensing. | CO4 | 3 |
| b. | Define Stoke’s shift of fluorescence. | CO5 | 3 |
| c. | Describe molecular chemionics with examples and illustrations. | CO5 | 14 |