Birla Institute of Technology and Science, Pilani
First Semester 2023-24
BITS 429-Nanoctechnology for Renewable Energy and Environment

Comprehensive Examination (Open Book)   20th December (2:00 P.M. to 5:00 PM)
Max Time: 180 min   **Total Max Marks:42**

Instructions:
1. You will get 30 days time to submit your work. Discuss with the IC whenever required.
2. Submit your answer paper only typed. Use Times New Roman font style, 12 font size, 1.5 line spacing, 1" margin all four sides, 0.25" tab in each paragraph starting.
3. Answer must be short, to the point (use bullet points), and technically sound
4. Use necessary figures, tables, and data from recent most literature (2019-2024) and must mention reference and URL with hyperlinks.
5. No copy-pasting acceptable. Use your own language only.

Q1 [18 M]
Take one (Let me know your choice in the provided Google form) measured propertied from each type nanosensor from the table below. Provide one recent most example of these nanosensors (material/structure of sensor, what it sense, sensibility limit, selectivity ratio etc) for each cases and make a table. Each student need to chose separate type/property combinations   [6 x 1]

Table 4.1   Various nanosensors

S.No.	Type	Measured property
1	Mechanical	Size, velocity, acceleration, mass flow, force, torque, pressure, acoustic wave, piezoelectric, strain, stress
2	Thermal	Temperature, specific heat, entropy, heat flow, flux
3	Electrical	Voltage, current, resistance, impedance, inductance, capacitance, dielectric constant, polarization, electric field, frequency, dipole moment
4	Magnetic	Field strength, flux density, magnetic moment, permeability
5	Optical	Intensity, frequency, phase, wavelength, polarization, reflectance, transmittance, refractive index,
6	Chemical	Composition, concentration, reaction rate, pH, oxidation/ reduction potential

Source of the table: B S Murty, P Shankar, Baldev Raj, BB Rath, and James Murday,, "Textbook of Nanoscience and Nanotechnology", Ch 4, p 119. University Press – IIM ; ed 2013, e-ISBN 978-3-642-28030-6; DOI 10.1007/978-3-642-28030-6.

(a) Discuss working principle of these nanosensors with proper data, figure, table etc   [6 x 1]
(b) What is the significance of nano for each cases? What could be problem if you use micro materials instead of nano? Explain from fundamental structure/property of materials point of view   [6 x 1]

Q2 Nano for air pollutant removal   **[12 M]**
(a) Chose two different nano adsorbents for one toxic gas removal. Compare the adsorbing capacity, selectivity and other important properties (essential for pollutant removal) of these nano adsorbents in a tabular form   [2 x 2]
(b) Discuss working principle of these nano adsorbents with proper data, figure, table etc   [2 x 2]
(c) What is the significance of nano for each cases? What could be problem if you use micro materials instead of nano? Explain from fundamental structure/property of materials point of view   [2 x 2]

Q3 Nano for water pollutant removal   **[12 M]**
(a) Chose two different nano materials/devices for one water pollutant removal. Compare the pollutant removal capacity, selectivity and other important properties (essential for pollutant removal) of these nano materials/devices in a tabular form   [2 x 2]

(b) Discuss working principle of these materials/devices with proper data, figure, table etc   [2 x 2]

(c) What is the significance of nano for each cases? What could be problem if you use micro materials instead of nano? Explain from fundamental structure/property of materials point of view   [2 x 2]

*****ALL THE BEST*****