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**END SEMESTER EXAMINATION – NOV / DEC 2024**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **17NT3005** | **Duration** | **3hrs** |
| **Course Title** | **FUNCTIONALIZATION OF NANOSTRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | What are carbon dots? What are the functional groups present on their surface? Describe the methods of modification of amino groups on carbon dots. | CO1 | U | 10 |
|  | b. | What are the types of carbon nanotubes? What are the common functional groups attached on carbon nanotubes? Discuss the functionalization methods of carbon nanotubes. | CO1 | U | 10 |
| **(OR)** | | | | | |
| 2. |  | What is the type of bon formed between thiol groups and gold nanoparticle surface? Explain the surface modification of gold nanoparticles by functional group attachment. | CO2 | R | 20 |
|  | | | | | |
| 3. |  | Explain Diels-Alder and Bingel reactions in the functionalization of graphene oxides. | CO2 | R | 20 |
| **(OR)** | | | | | |
| 4. |  | What are magnetic nanoparticles? What are the types of iron oxides based on stoichiometry? Explain the functionalization of iron oxide nanoparticles with suitable examples. | CO3 | R | 20 |
|  | | | | | |
| 5. |  | Explain the stability of magnetic nanoparticles and ligand modification of them. | CO3 | An | 10 |
| **(OR)** | | | | | |
| 6. |  | What are the methods of synthesis of silicon dioxide nanoparticles? Explain their biocompatibility and applications. | CO4 | A | 20 |
|  |  |  | |  |  |
| 7. |  | Discuss the applications of magnetic nanoparticles in drug delivery. | CO4 | An | 20 |
|  |  | **(OR)** | |  |  |
| 8. |  | Explain the applications of quantum dots in diagnosis and treatment of chronic diseases. | CO5 | A | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Elaborate the functionalization methods and biomedical applications of semiconductor quantum dots. | CO6 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate the mechanism of functionalization |
| CO2 | Infer the metal oxide, organic functionalization in carbon nanomaterials |
| CO3 | To solve problems on functionalization methods. |
| CO4 | To choose reagents for deriving functional groups on nanomaterials. |
| CO5 | To envisage the tailoring of properties of nanomaterials based on functionalization. |
| CO6 | To understand recent newer developments in functionalized nanomaterials for plausible new devices |

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| **Assessment Pattern as per Bloom’s Taxonomy** | | | | | | | |
| CO / BL | **Remember** | **Understand** | **Apply** | **Analyze** | **Evaluate** | **Create** | **Total** |
| CO1 | - | 20 | - | - | - | - | 20 |
| CO2 | 40 | - | - | - | - | - | 40 |
| CO3 | 20 | - | - | 10 | - | - | 30 |
| CO4 | - | - | 20 | 20 | - | - | 40 |
| CO5 | - | - | 20 | - | - | - | 20 |
| CO6 | 20 | - | - | - | - | - | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **16NT3006 / 17NT3006** | **Duration** | **3hrs** |
| **Course Title** | **NANOSAFETY AND ENVIRONMENTAL ISSUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | To respond to the challenges posed by nanoparticles in which areas research needed to be carried out and explain each of them? | CO1 | A | 15 |
|  | b. | What is the problem with nanoparticles with respect to safety on human and environment? | CO1 | U | 05 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | What are the various engineering control methods practiced in nanoparticle risk reduction methodology? | CO1 | A | 10 |
|  | b. | Analyse the effect of inhalation and deposition of nanoparticles on human. | CO2 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Discus the effect of SWCNT on the pulmonary track. | CO2 | U | 10 |
|  | b. | Analyse the role of material characterisation in risk reduction process. | CO2 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Analyse the process of systemic translocation of inhaled nano particles. | CO3 | An | 12 |
|  | b. | What are the distinct mechanisms concerning the deposition of solid material? | CO3 | R | 08 |
|  |  |  |  |  |  |
| 5. | a. | Explain the two distinctive mechanisms of clearance of solid material from the lungs. | CO3 | U | 10 |
|  | b. | How nanoparticles are inhaled and deposited in human respiratory system? | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Analyse the end point classification in ecotoxicological test. | CO4 | U | 06 |
|  | b. | Explain the ecotoxicity measurement used for polychlorinated biphenyls. | CO4 | A | 14 |
|  |  |  |  |  |  |
| 7. |  | What are the various eco-toxicological tests and explain how they are able to ascertain the toxicity of a material. | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe the measurement of genotoxicity by using AMES test. | CO4 | R | 10 |
|  | b. | Explain how bioethics principles are to be followed in nanotechnology? | CO5 | U | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Discuss in detail the FDA regulations on ENMs. | CO6 | U | 10 |
|  | b. | Analyse the FDA regulation on nanosafety and environmental issues. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Relate the toxic effects of nanotechnology on human health. |
| CO2 | Analyse the various issues on environmental effects. |
| CO3 | Identify suitable remedial measures. |
| CO4 | Suggest start-of-the pipe solution for environmental issues based on nanomaterials. |
| CO5 | Workout problems on nanomaterial related to toxicity. |
| CO6 | To frame a model policy on preventing health hazard. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 05 | 25 |  |  |  | 30 |
| CO2 | 10 | 10 |  | 10 |  |  | 30 |
| CO3 | 08 | 10 |  | 22 |  |  | 40 |
| CO4 | 10 | 06 | 34 |  |  |  | 50 |
| CO5 |  | 10 |  |  |  |  | 10 |
| CO6 |  | 10 | 10 |  |  |  | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **17NT3019** | **Duration** | **3hrs** |
| **Course Title** | **SYNTHESIS AND APPLICATIONS OF NANOMATERIALS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | List three examples of 0D, 1D, 2D, and 3D nanomaterials. | CO1 | R | 12 |
|  | b. | Design a research project that incorporates both top-down and bottom-up synthesis techniques for developing a novel nanomaterial. Outline your methodology and expected outcomes. | CO1 | C | 8 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Define laser ablation. | CO2 | R | 2 |
|  | b. | Describe the process of laser ablation in the preparation of nanomaterials, with an example. | CO2 | U | 18 |
|  |  |  |  |  |  |
| 3. | a. | Explain the utilization of self-assembly in the fabrication of nanostructures. | CO3 | A | 5 |
|  | b. | Differentiate between solvothermal and hydrothermal methods in the synthesis of nanomaterials. | CO3 | An | 15 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Apply the templated synthesis method to create a specific nanomaterial, and describe the steps involved in the process. | CO4 | A | 20 |
|  |  |  |  |  |  |
| 5. |  | Analyze the functions of each component in a molecular beam epitaxy (MBE) unit and discuss its overall working principle. | CO5 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Evaluate the pulsed laser deposition (PLD) process for thin film fabrication, analyzing its key stages and impact on film quality, with a suitable sketch. | CO5 | E | 10 |
|  | b. | Illustrate the types of chemical vapor deposition (CVD) techniques and outline their advantages, disadvantages, and applications in various industries. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. | a. | Analyze the different types of carbon nanotubes based on chirality and discuss how variations in chirality affect their electronic, mechanical, and thermal properties. | CO1 | An | 10 |
|  | b. | Describe the arc discharge and laser ablation methods of fabricating carbon nanotubes. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Define zeolites and provide examples. | CO4 | R | 3 |
|  | b. | Evaluate the methods of preparation for ordered mesoporous structures, discussing their effectiveness and suitability for specific applications. | CO4 | E | 17 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Evaluate the concepts of molecular electronics and nanoelectronics, discussing their applications, advantages, and potential limitations. | CO6 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Demonstrate knowledge on various types of nanomaterials |
| CO2 | Choose the different physical methods in preparing nanomaterials |
| CO3 | Utilize the different chemical methods in preparing nanomaterials |
| CO4 | Select the suitable methods for synthesis of different nanomaterials |
| CO5 | Experiment the different technique for nanomaterial coatings |
| CO6 | Appraise the advanced techniques like lithography |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 12 |  |  | 10 |  | 8 | 30 |
| CO2 | 2 | 28 |  |  |  |  | 30 |
| CO3 |  |  | 5 | 15 |  |  | 20 |
| CO4 | 3 |  | 30 |  | 17 |  | 50 |
| CO5 |  |  |  | 20 | 10 |  | 30 |
| CO6 |  |  |  |  | 20 |  | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **17NT3039** | **Duration** | **3hrs** |
| **Course Title** | **SEMICONDUCTOR NANOSTRUCTURES AND NANO-PARTICLES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Describe the finite potential square well and discuss the first three energy levels and their corresponding wave functions. | CO1 | U | 15 |
|  | b. | Compare the harmonic oscillator potential well and the triangular potential well, focusing on their characteristics and implications in quantum mechanics. | CO1 | An | 5 |
|  |  | **(OR)** |  |  |  |
| 2. | a. | Describe the strained layers in semiconductor nanostructures. | CO1 | U | 10 |
|  | b. | Analyze the band structure of quantum wells and illustrate it with a schematic. | CO1 | An | 10 |
|  |  |  |  |  |  |
| 3. | a. | Apply the spray pyrolysis method for depositing metal oxide nanofilms and explain the effect of process parameters on the thickness of the films. | CO2 | A | 15 |
|  | b. | Compare the physical and chemical methods of nanomaterials synthesis in terms of their applications in semiconductor devices. | CO2 | An | 5 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Demonstrate the chemical vapor deposition method for preparing nanomaterials with a neat schematic. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 5. | a. | Evaluate the surface-to-volume ratio for bulk and nanostructures. | CO3 | E | 8 |
|  | b. | Classify the quantum structures resulting from the size reduction of bulk materials into one-dimensional, two-dimensional, and three-dimensional forms. | CO3 | U | 12 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain the working of quantum dot solar cell and its advantages over bulk semiconductors using solar cell parameters. | CO4 | A | 20 |
|  |  |  |  |  |  |
| 7. | a. | List the potential application of semiconductor nanowires. | CO5 | R | 5 |
|  | b. | Analyze the semiconductor nanomaterials that are suitable for Light Emitting Diodes (LEDs). | CO5 | An | 15 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Evaluate the photovoltaic parameters using the volt-ampere characteristic plot. | CO4 | E | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Design a single-electron transistor and plot the IV characteristics, depicting the step potential. | CO6 | C | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Analyse the Semiconductor Nanostructure |
| CO2 | Demonstrate the method for nanostructure fabrication techniques |
| CO3 | Appraise the physical properties of nano materials |
| CO4 | Evaluate the parameters of nanodevices through optical and electrical characteristics |
| CO5 | Analyse the nanowire-based devices and the methods of fabrication |
| CO6 | Design nano devices with different quantum nanostructure |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 |  | 25 |  | 15 |  |  | 40 |
| CO2 |  |  | 35 | 5 |  |  | 40 |
| CO3 |  | 12 |  |  | 8 |  | 20 |
| CO4 |  |  | 20 |  | 20 |  | 40 |
| CO5 | 5 |  |  | 15 |  |  | 20 |
| CO6 |  |  |  |  |  | 20 | 20 |
|  | | | | | | | **180** |

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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20NT3003** | **Duration** | **3hrs** |
| **Course Title** | **ANALYTICAL METHODS AND SPECTROSCOPY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 × 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Define standard deviation with an example. | CO1 | U | 4 |
|  | b. | Explain the factors affecting vibrational frequencies in IR spectroscopy. | CO2 | U | 8 |
|  | c. | Correlate the correct structures of the compounds in the list with their corresponding IR spectra.  (i) ir spectrum practice problems which molecule c5h10o given spectrum identify molecule multiple choice  c5h10o ir spectrum mystery compound which is it  (ii)  ir spectroscopy practice for molecule c6h12o which of these 4 molecules is it  ir spectrum for c6h12o what is it  (iii)  ir spectroscopy practice which of these 5 molecules with c6h140 is the molecule practice problem  ir spectrum of mystery compound c6h14o  (iv)  whic of these 4 molecules c4h8o2 corresponds to ir spectroscopy practice  practice problem ir spectroscopy c4h8o2 | CO3 | An | 8 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Explain the principles and applications of Raman spectroscopy. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Describe the types of electronic transitions in organic molecules which can be observed in UV-vis spectroscopy. | CO4 | U | 10 |
|  | b. | Explain Franck-Condon principle with a suitable diagram. | CO4 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. | a. | Explain various photophysical processes that occur in organic molecules by constructing a Jablonski diagram. | CO5 | U | 12 |
|  | b. | Describe Förster Resonance Energy Transfer with an example. | CO5 | U | 8 |
|  |  |  |  |  |  |
| 5. | a. | Explain the physical principles of NMR spectroscopy. | CO3 | U | 10 |
|  | b. | (i) The 1H NMR spectrum of compound X (**C4H8O2**) is shown below. It also shows a strong IR absorption band near 1730 cm−1. Propose a structure for**X**.    (ii) The 1H NMR spectrum of compound X (**C2H3Cl3**) is shown below. Propose a structure for X.    (iii) The 1H NMR spectrum of compound X (**C2H4Cl2**) is shown below. Propose a structure for X. | CO3 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Describe the factors affecting chemical shift in NMR spectroscopy. | CO4 | U | 10 |
|  | b. | (i) The 1H NMR and 13C spectra of compound X (**C5H10Cl2**) are shown below. Propose a structure for X.      (ii) The 1H NMR and 13C spectra of compound **X** (C6H12O2) are shown below. Propose a structure for **X**. | CO4 | An | 10 |
|  |  |  |  |  |  |
| 7. | a. | Explain the concepts of spin-spin relaxation and spin-lattice relaxation in NMR. | CO6 | U | 10 |
|  | b. | (i) The 1H NMR and 13C spectra of compound X (**C4H6O2**) are shown below. Propose a structure for X.      (ii) The 1H NMR of compound X (**C5H8O2**) are shown below. Propose a structure for X. | CO6 | An | 10 |
|  |  | **(OR)** |  |  |  |
| 8. | a. | Describe d-d and CT transitions in electronic spectroscopy. | CO4 | U | 10 |
|  | b. | Explain the phenomena of dual fluorescence and fluorescence quenching, and fluorescence quantum yield. | CO5 | U | 10 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Describe the principles and applications of X-ray Photoelectron Spectroscopy. | CO5 | U | 10 |
|  | b. | Define: Accuracy, Precision, Mean, and Confidence interval. | CO1 | U | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Ability to express scientific data in proper forms and calculate errors in measurements. |
| CO2 | Advanced level knowledge on the interactions of electromagnetic radiation with matter and their applications. |
| CO3 | Ability to interpret IR spectral data and detect functional groups in molecules and functionalized nanomaterials. |
| CO4 | Analytical skill on various electronic transitions and thereby derive the ground state electronic properties of molecules and materials. |
| CO5 | Application of fluorescent molecules in suitable areas with an articulation of their excited state behavior and radiative property. |
| CO6 | Skill on solving problems related to the structure of organic compounds and molecular interactions by NMR spectroscopy. |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | - | 14 |  |  |  |  | 14 |
| CO2 | - | 8 |  |  |  |  | 8 |
| CO3 | - | 30 |  | 18 |  |  | 48 |
| CO4 | - | 40 |  | 10 |  |  | 50 |
| CO5 | - | 40 |  | - |  |  | 40 |
| CO6 | - | 10 |  | 10 |  |  | 20 |
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**END SEMESTER EXAMINATION – NOV / DEC 2024**

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| --- | --- | --- | --- |
| **Course Code** | **20NT3019** | **Duration** | **3hrs** |
| **Course Title** | **CANCER NANOMEDICINE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 × 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Some aromatic compounds failed to respond to carcinogenicity tests in vitro. Justify the statement by providing a suitable example. | CO1 | A | 10 |
|  | b. | Define: adenoma, sarcoma, polyp, melanoma, carcinoma, leukemia, metastasis, hyperplasia, benign tumor, and angiogenesis. | CO1 | R | 10 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Describe proto-oncogenes and tumor suppressor genes. Explain how the proto-oncogenes were conceptualized by Robert Weinberg. | CO1 | U | 20 |
|  |  |  |  |  |  |
| 3. | a. | Describe the types of mutation that lead to the onset of cancer. | CO2 | U | 10 |
|  | b. | Explain how Gleevec and Sprycel were discovered through the understanding of cancer biology. | CO2 | U | 10 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Explain chemotherapeutic method of treating cancer. Explain the role of alkylating agents and biological response modifiers in chemotherapy for cancer. | CO3 | U | 20 |
|  |  |  |  |  |  |
| 5. |  | Describe the role of hormones and topoisomerase inhibitors in the treatment of cancer. | CO3 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 6. | a. | Explain the instrumental method of positron emission tomography in the diagnosis of cancer. | CO4 | A | 10 |
|  | b. | Explain the working and application of ultrasonography in the diagnosis of cancer. | CO4 | A | 10 |
|  |  |  |  |  |  |
| 7. |  | Explain how inorganic nanoparticles are applied in in the identification of cancer in patients. | CO5 | U | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Describe the role of noble metal nanoparticles in the diagnosis of cancer. | CO6 | U | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Describe the application of magnetic nanoparticles in targeted anticancer drug delivery. Explain the design principles employed to make nanomaterials suitable for drug transport. | CO6 | U | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | The student will be able to:  Demonstrate the mechanism of mutation and cancer-causing cells |
| CO2 | Identify the different cancer diagnosis techniques |
| CO3 | To explain the pros and cons of cancer nanotechnology methods |
| CO4 | To justify the best method from the student’s perspective |
| CO5 | To choose methods of improvising cancer diagnosis and treatment using nanomaterials |
| CO6 | Demonstrate the applications of nanomaterials in cancer diagnosis and treatment |

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| **Assessment Pattern as per Bloom’s Level** | | | | | | | |
| **CO / BL** | **R** | **U** | **A** | **An** | **E** | **C** | **Total** |
| CO1 | 10 | 20 | 10 | - | - | - | 40 |
| CO2 | - | 20 | - | - | - | - | 20 |
| CO3 | - | 40 | - | - | - | - | 40 |
| CO4 | - | - | 20 | - | - | - | 20 |
| CO5 | - | 20 | - | - | - | - | 20 |
| CO6 | - | 40 | - | - | - | - | 40 |
|  | | | | | | | **180** |