R8405

Sub. Code
540201

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Energy Science

ENVIRONMENTAL SCIENCE

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Section A (10 × 1 = 10)

Answer **all** questions.

1. Which of the following is not a constituent of DDT?
   (a) Carbon
   (b) Fluorine
   (c) Chlorine
   (d) Hydrogen

2. Which is the gas that causes eye irritation as a result of photochemical smog?
   (a) CO_2 (b) O_2
   (c) CH_4 (d) Acrolein

3. The hardness of water is due to the presence of salts of _____.
   (a) Potassium
   (b) Chlorine
   (c) Magnesium
   (d) Boron

4. 1 ppm = ————————.

(a) 10 mg/L (b) 1 mg/L

(c) 10 g/L (d) 1 g/L

5. Which of the following is a greener route to produce ethanol commercially?

(a) Catalytic cracking of ethanol

(b) Oxidation of ethene with an ionic catalyst

(c) Steam reforming of methanol

(d) Dehydrogenation of ethylene

6. Name the conventional solvent that was used for dry cleaning purposes which later confirmed to be a suspected carcinogen.

(a) Supercritical CO_2

(b) Phenanthrene

(c) Tetrachloroethene

(d) Benzene aldehyde

7. ———————— is the fundamental advantage of the sonochemistry in organic synthesis without solvents.

(a) High yields

(b) High energy requirements

(c) Use of solvents

(d) High wastes

8. A desirable green solvent should be ————————.

(a) Costly

(b) Toxic

(c) Readily available

(d) Synthetic

9. Green chemistry improves ———————— of chemical manufacturers.

(a) Competitiveness

(b) Easiness of production

(c) Services

(d) Chemicals

10. An ideal solvent facilitates the ————————.

(a) Mass transfer

(b) Dissolving property

(c) Combustion

(d) Titration

Section B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) What are pollutants? Give an example for water pollutants.

Or

(b) Write a note on nuclear hazards.

12. (a) Explain about water quality parameters.

Or

(b) Explain the process of water treatment by ion exchange method.

13. (a) Write a note on green chemistry.

Or

(b) How to prevent chemical accidents? What are the precautions taken during synthesis?

14. (a) Explain in detailed about the selection of starting materials in green synthesis.

Or

(b) Write a note on microwave assisted synthesis.

15. (a) Discuss about the advantages of green technologies.

Or

(b) List out the Biological applications of green synthesis.

Section C $(5 \times 8 = 40)$

Answer any **five** questions.

16. Describe the source of environmental pollution.

17. Discuss the effects and control measures of air pollution.

18. Explain: DO, BOD and COD. (3+3+2)

19. Describe the primary water treatment methods.

20. Explain principles of green chemistry.

21. Illustrate an example of polymer supported catalysts for green synthesis.

22. Explain the synthesis and applications of biocatalyst.

23. Write about application of green technology in energy and environment applications.

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R8406	Sub. Code
	540202

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Energy Science

SOLAR THERMAL ENERGY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Section A $(10 \times 1 = 10)$

Answer **all** questions.

1. Angle made by plane surface with horizontal is called _____.

   (a) Slope

   (b) Altitude angle

   (c) Zenith angle

   (d) Hour Angle

2. Which type of device is used to measure solar irradiance on a planar surface?

   (a) Pyranometer

   (b) Net radiometer

   (c) Gardon gauge

   (d) Pyrheliometer

3. Why does flat plate collector perceived to have higher efficiency than evacuated tube solar collector in terms of area?

(a) Because flat plate collector has a large installation area

(b) Because evacuated tube collector is compact

(c) Because of the vacuum gap in evacuated tube collectors

(d) Because of the vacuum gap in flat plate collectors

4. Which of the following provides highest energy conversion efficiency in non-concentrating solar collectors?

(a) Flat plate collectors

(b) Evacuated flat plate collectors

(c) Evacuated-tube collectors

(d) Parabolic collectors

5. The ———————— focus concentrated sunlight on a receiver which sits on top of the tower.

(a) Heliostats (b) Heliocentric

(c) Heliosphere (d) None of the above

6. What is the operating temperature (in Celsius) of turbines in a central receiver thermal power system?

(a) 10 – 100°C (b) 5000°C

(c) 500 – 800°C (d) 200 – 500°C

7. Which of the following processes take place in solar distillation?

(a) Evaporation (b) Condensation

(c) Both (a) and (b) (d) Solidification

8. Which of the following is an example of passive solar technology?

(a) Photovoltaic

(b) Solar furnace

(c) Active solar water heating systems

(d) Solar thermo-mechanical systems

9. Solar water system is suitable for

(a) Food industry

(b) Semiconductor industry

(c) Residential applications

(d) Liquid adsorption

10. Solar air collectors transfer sun's thermal energy to air via ————————.

(a) Conduction (b) Convection

(c) Seebeck effect (d) Peltier effect

Section B ($5 \times 5 = 25$)

Answer **all** questions, choosing either (a) or (b).

11. (a) Discuss about terrestrial and extra-terrestrial radiation.

Or

(b) Write a note on depletion of solar radiation.

12. (a) How does a solar thermal collector work?

Or

(b) Explain the swimming pool absorber.

13. (a) Explain with a schematic diagram of low temperature solar power plant.

Or

(b) Discuss the working principle of solar pond electric power plant.

14. (a) Discuss about the solar space heating.

Or

(b) Explain the solar powered refrigerant.

15. (a) Briefly explain the solar panel technologies.

Or

(b) Discuss about the solar thermal market.

Section C $(5 \times 8 = 40)$

Answer any **five** questions.

16. Discuss about the spectral energy distribution of solar radiation.

17. Discuss in detail about the instrumentation of solar radiation measurement.

18. Explain the working principle of flat plate collector.

19. Briefly explain the air based collector and evacuated tube collector.

20. Explain briefly thermodynamic cycles.

21. Discuss the working principle of solar pond electric power plant.

22. Discuss in detail about solar heating and solar cooling system.

23. Explain the outlook and development of industrial solar systems.

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R8407	Sub. Code
	540203

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Energy Science

HYDROGEN ENERGY SYSTEMS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Section A (10 × 1 = 10)

Answer **all** questions.

1. What is photocatalytic water splitting?
   (a) Splitting of water using catalyst and electricity
   (b) Splitting of water using electricity
   (c) Combining hydrogen and oxygen to form water
   (d) Splitting of water using light as catalyst

2. Which of the following supplies maximum amount of hydrogen gas?
   (a) Natural gas
   (b) Anaerobic Digestion
   (c) Wastewater treatment
   (d) Electrolysis

3. How is hydrogen gas produced from fossil fuels?
   (a) Partial oxidation of methane
   (b) Electrolysis
   (c) Evaporation
   (d) Biomass gasification

4. What is the main problem in using hydrogen as fuel for vehicles?

   (a) Capital intensive

   (b) Storage

   (c) Fuel cell technology is not well established

   (d) Cars will become heavy

5. Which of the following temperature ranges are suitable for biomass gasification?

   (a) Above 1000 degree Celsius

   (b) Between 500 and 600 degree Celsius

   (c) Between 700 and 1000 degree Celsius

   (d) Less than 500 degree Celsius

6. How is the biomass material and gasification agent fed into an updraft gasifier?

   (a) Biomass from top, gasifying agent from top

   (b) Biomass from top, gasifying agent from bottom

   (c) Biomass from bottom, gasifying agent from top

   (d) Biomass from bottom, gasifying agent from bottom

7. Which of the following uses hydrogen as fuel?

   (a) Vehicles (b) AA battery

   (c) AAA battery (d) Power plants

8. What are the main components of a fuel cell?

   (a) Anode, cathode, electrolyte

   (b) Anode, cathode, membrane and electrolyte (including fuel)

   (c) Anode, cathode

   (d) Anode, cathode, electrolyte and connecting wires

9. Why hydrogen fuel is hazardous?

(a) Because of high ignition and low combustion energy

(b) Because of high ignition and high combustion energy

(c) Because low ignition and low combustion energy

(d) Because of low ignition and high combustion energy

10. By what means can hydrogen be stored?

(a) Physically and chemically

(b) As atoms

(c) As ions

(d) As fuel cells

Section B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Mention the properties of hydrogen as a fuel.

Or

(b) Explain the thermochemical water splitting.

12. (a) Explain the process of natural gas reforming.

Or

(b) Discuss the partial oxidation processes.

13. (a) Explain the production of hydrogen by biochemical pathway.

Or

(b) Write a note on hydrogen inhibition.

14. (a) Explain the electrochemistry of fuel cell.

Or

(b) Mention the applications of fuel cell.

15. (a) Briefly explain the compressed hydrogen storage.

Or

(b) Write the advantage and disadvantage of hydrogen as a transport fuel.

Section C $(5 \times 8 = 40)$

Answer any **five** questions.

16. Discuss in detail about the hydrogen production plants.

17. Explain the hydrogen evolution reaction and oxygen evolution reaction.

18. Explain the characteristics of steam methane reforming processes.

19. Explain the production of hydrogen from coal and other fuels.

20. Explain biohydrogen production from agricultural waste.

21. Explain the principle and working of direct borohydride fuel cell.

22. Describe the large stationary power generation.

23. Discuss the methods of physical storage of hydrogen.

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R8408	Sub. Code
	540503

M.Sc. DEGREE EXAMINATION, APRIL – 2023

Second Semester

Energy Science

ADVANCED NANOMATERIALS AND THEIR APPLICATIONS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 1 = 10)$

Answer **all** the questions.

1. What is the standard form of CNT

   (a) Carbon Nanotubes

   (b) Carbon Nanographene Tubes

   (c) Carbide Nanographene Tubes

   (d) None of the above

2. The size of the one-dimensional nanocrystals and clusters (quantum dots) is ———————— diameter

   (a) 1-10nm (b) 1-7mm

   (c) 1-10m (d) None of the above

3. Which one of the following is an example for top-down approach?

(a) Ball milling technique

(b) Sol-gel process

(c) Both (a) and (b)

(d) None of the above

4. The polymeric nanoparticles come under ———— dimensional

(a) Zero (b) One

(c) Two (d) Three

5. For ferromagnetic materials magnetic susceptibility is

(a) Positive and large

(b) Positive and small

(c) Negative and small

(d) Negative and large

6. Which of the following is not a magnetic material?

(a) Nickel (b) Gold

(c) Wood (d) Iron

7. Quantum dots can be used for

(a) Optoelectronics (b) Mechanics

(c) Crystallography (d) Quantum physics

8. Which property of nanomaterials makes them suitable to be used for elimination of pollutants?

(a) High purity (b) Better thermal conductivity

(c) Small size (d) Enhanced chemical activity

9. A solar cell is a

(a) P-type semiconductor

(b) N-type semiconductor

(c) P-N junction

(d) Intrinsic semiconductor

10. What is the main advantage of using nanomaterials in water purification

(a) Increased adsorption

(b) Increased surface area

(c) Increased conductivity

(d) Increased energy density

Part B $(5 \times 5 = 25)$

Answer **all** questions, choosing either (a) or (b).

11. (a) Briefly explain the quantum confinement effect.

Or

(b) List down the significance of nanoscale.

12. (a) Explain about microwave irradiated method synthesis?

Or

(b) Write a note on RF arid magnetron sputtering.

13. (a) Discuss various kinds of carbon nanotubes.

Or

(b) List down the future challenges in the synthesis of metal oxide nanocomposites.

14. (a) Briefly explain the synthesis of biopolymers.

Or

(b) How are magnetic materials classified?

15. (a) Describe any two applications of nanomaterials in electrochemical analysis.

Or

(b) Explain the applications of nanomaterials in biosensors.

Part C $(5 \times 8 = 40)$

Answer any **five** questions.

16. Explain the classification of nanomaterials?

17. Describe the spray pyrolysis method for the synthesis of nanomaterials

18. Briefly explain the polymer nanocomposites and its applications

19. Discuss the various physical methods of synthesizing nanomaterials?

20. Explain the uses of nanomaterials in the following

(a) Water purification and Dye sensitized solar cell

(b) Cancer detection and Tissue engineering (4+4)

21. (a) How are biomaterials classified?

(b) Discuss the applications of bioplastics (4+4)

22. Define super para magnetism. How does it differ from ferromagnetism?

23. Write an essay about the applications of nanomaterials in electrical devices.

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