R–4632

Sub. Code
540201

M.Sc. DEGREE EXAMINATION, APRIL 2021

Second Semester

Energy Science

ENVIRONMENTAL SCIENCE

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is carbon credit?

2. Define VOC and TDS.

3. What is electrodialysis?

4. Explain anaerobic digestion.

5. Define atom economy.

6. List out the uses of catalytic reagents.

7. What is meant by catalysts?

8. What do you mean by green solvents?

9. Describe principle of sustainable development.

10. Define carbon trading.

Part B (5 × 5 = 25)

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

11. (a) Enlist and explain the factors affecting the BOD test.

Or

(b) Explain the causes, effects and control measures of water pollution.

12. (a) Explain trickling filter with sketch. Discuss design parameters.

Or

(b) Explain the role of activated carbon in water treatment process.

13. (a) Calculate the atom economy of the following reaction. The fermentation of the sugar to make ethanol

$C_6H_{12}O_6(aq.)2C_2H_5OH(aq.)+2CO_2(g)$

Or

(b) Write short notes on designing biodegradable products.

14. (a) Write briefly about designing green synthesis.

Or

(b) Write short notes on synthesis involving principles of green chemistry.

15. (a) Briefly explain about the phase transfer catalysis.

Or

(b) What is meant by carbon capture and explain it briefly?

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Elaborate on water quality parameters.

17. Give the principle of sedimentation. Add a note on vertical sedimentation with neat labelled diagram.

18. Write twelve principles of green chemistry with explanation.

19. Explain briefly about the applications of green chemistry in pharmaceutical industry.

20. Write short notes on following:
    (a) Phase transfer catalysis
    (b) Microwave assisted reaction in water.

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R–4633

Sub. Code
540202

M.Sc. DEGREE EXAMINATION, APRIL 2021

Second Semester

Energy Science

PHOTOVOLTAICS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

1. What is meant by bandgap in semiconductor?

2. What are elemental semiconductors?

3. What is a P-N junction?

4. What is a thin film deposition technique?

5. What is PV cell and PV module?

6. What is difference between polycrystalline and monocrystalline solar panels?

7. What are the components of a solar PV system?

8. How do solar PV systems work?

9. What are solar connectors?

10. Can you connect solar panels in parallel?

Part B (5 × 5 = 25)

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

11. (a) Distinguish between direct and indirect band gap semiconductors.

Or

(b) Summarize about the extrinsic semiconductor.

12. (a) Explain the physical vapour deposition method in detail.

Or

(b) Discuss about molecular beam epitaxy.

13. (a) Discuss the module structuring and assembly in solar cell.

Or

(b) Describe the module testing and analysis.

14. (a) Discuss the module and array of solar PV system components.

Or

(b) Explain the charge controllers and inverters.

15. (a) Discuss the solar photovoltaic concentrators.

Or

(b) Describe the hybrid SPV power systems.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain the doping, carrier concentration, mobility, and conductivity in extrinsic semiconductor.

17. Using a neat diagram, describe the metal organic chemical vapour deposition in detail.

18. Discuss the crystalline and thin film solar modules.

19. Describe the purpose of photovoltaic system in telecommunication and water pumping.

20. Briefly explain the SPV power plant design tools and methodologies.

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R–4634

Sub. Code
540203

M.Sc. DEGREE EXAMINATION, APRIL 2021

Second Semester

Energy Science

ENERGY STORAGE SYSTEMS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. How is a lead acid battery constructed?

2. What are active materials in lead acid batteries?

3. What is the difference between a lithium battery and a lithium ion battery?

4. How do you find the specific capacity of a battery?

5. Indicate how a metal -air battery works.

6. Reproduce the principle of lithium air batteries?

7. Define proton exchange membranes.

8. State the regenerative fuel cell.

9. Differentiate battery and supercapacitor.

10. Define hybrid fuel cell and its applications.

Part B (5 × 5 = 25)

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

11. (a) Analyze the characteristics and properties of sulfuric acid.

Or

(b) Summarize about automotive batteries.

12. (a) List out the merits and demerits of Lithium- ion battery.

Or

(b) Investigate the TiO_2 nanomaterials as anode Materials for Lithium-ion batteries.

13. (a) Explain the working principle of sodium-air batteries.

Or

(b) State the reaction formula and storage density of Zinc-air batteries.

14. (a) Explain fuel cell catalysts and its applications in detail.

Or

(b) Illustrate the Fundamentals of Gas Diffusion Layers in fuel cells.

15. (a) Explain the concept of hybrid energy systems.

Or

(b) Classify and summarize the battery-supercapacitor hybrid systems.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Describe the advantages and disadvantages of lead acid batteries in detail.

17. Explain the SnO_2 and NiO anode materials for lithium-ion battery.

18. Explain the design and operation of lithium-air batteries with neat diagram.

19. Outline the types and applications of fuel cells.

20. Design of a hybrid fuel cell with battery energy storage for stand-alone distributed generation applications.

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R5471	Sub. Code 540401

M.Sc. DEGREE EXAMINATION, APRIL – 2021.

Fourth Semester

Energy Science

ENERGY AUDIT AND MANAGEMENT

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** the questions.

1. Define the term energy management.
2. What is the need to study energy management?
3. What is energy audit?
4. What is meant by production factor?
5. Write about the perspective of energy policy?
6. What are the requirements of energy audit planning?
7. Define energy balance.
8. What is the first law of efficiency?
9. Write about energy saving method?
10. Mention any two energy audit instruments and their uses.

Part B (5 × 5 = 25)

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

11. (a) Write a note on principle of energy management

Or

(b) Discuss about energy management strategy.

12. (a) List out the steps followed for pre-audit phase activities.

Or

(b) Illustrate with an example of maximizing system efficiency.

13. (a) What is the role and responsibilities of energy manager?

Or

(b) Discuss about communication, training and planning.

14. (a) Explain the methods for preparing process flow in energy system.

Or

(b) Identify the losses and improvements occurred in energy balance sheet.

15. (a) Discuss about the methods of energy savings and its consequence.

Or

(b) Write the accuracy for the process of energy audit

Part C

$(3 \times 10 = 30)$

Answer any **three** questions.

16. Discuss the need and objectives of Energy audit and management.

17. Explain in detail about the methodology of detailed energy audit.

18. Write in detail about policy and planning of energy audit

19. Discuss about energy management information system(MIS).

20. Explain about energy audit instruments and mention the details of monitoring energy audit.

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R–4635

Sub. Code
540502

M.Sc. DEGREE EXAMINATION, APRIL 2021

Second Semester

Energy Science

ADVANCED NANOMATERIALS AND THEIR APPLICATIONS

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 2 = 20)

Answer **all** questions.

All questions carry equal marks.

1. Write any four uses of CNT.
2. Write different modes of classification of Nanomaterials.
3. What are hybrid metals? How are they used in nano composites?
4. Mention the applications of nano hybrid materials.
5. Give any four examples for Implant materials.
6. Mention the different types of nanomaterial used in biomaterials.
7. What are magnetic nanomaterials?
8. What are the physical properties of magnetic nanomaterials?
9. List out the Applications of Nanotechnology in electronics.
10. What are nanosensors?

Part B (5 × 5 = 25)

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

11. (a) Explain electro spinning synthesis of nanoparticles.

Or

(b) Discuss the methods of synthesizing nanorods and nano wires.

12. (a) Describe the applications of hybrid materials.

Or

(b) Explain how polymer composite materials used in energy storage materials.

13. (a) Write short notes on wind characteristics and Meteorology of wind.

Or

(b) Enumerate the different criteria for selecting a wind farm.

14. (a) Write a note on magnetic hysteresis.

Or

(b) Discuss the applications of ferrites nanomaterials.

15. (a) Explain the applications of nanomaterials in fuel cell and self cleaning process.

Or

(b) Describe the uses of nanomaterials in solar cells.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. (a) Explain the role of bottom up and top down approaches in nanotechnology.

    (b) Explain Chemical Vapor Deposition of Carbon Nanotubes (5+5)

17. Write short notes on

    (a) Natural fibre composites

    (b) Thermal properties of CNT-metal oxide composites (5+5)

18. Explain the following:

    (a) Synthetic biodegradable polymer

    (b) bioinert biomaterials (5+5)

19. What are soft and hard magnetic materials? Discuss their preparation and applications.

20. Describe the applications of nanomaterials in

    (a) electrochemical analysis

    (b) water purification

    (c) magnetic devices (3+4+3)

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R5472	Sub. Code 540507

M.Sc. DEGREE EXAMINATION, APRIL – 2021.

Fourth Semester

Energy Science

CLIMATE CHANGE AND CO_2 EMISSION ASSESSMENT

(CBCS – 2019 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A $(10 \times 2 = 20)$

Answer **all** the questions.

1. Name some renewable energy sources.
2. What are the economic problems related to energy usage?
3. Define global climate change.
4. What is green house effect?
5. How to measure CO_2 emission?
6. What are the major sources for CO_2 emission?
7. How to reduce carbon foot print?
8. What is emission factor?
9. Define Carbon credit.
10. What are the limitations of carbon trading mechanism?

Part B (5 × 5 = 25)

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

11. (a) Illustrate climate change impact on energy sector.

Or

(b) Discuss about the various renewable energy sources and their technologies.

12. (a) Explain the mechanism of green house gas emission.

Or

(b) Discuss the migration effects during global climate change.

13. (a) Explain in detail on technology for reduction of CO_2 emission.

Or

(b) What are the alternative resources on reduction of CO_2 emission?

14. (a) Write a note on carbon foot print?

Or

(b) Illustrate with an example of CO_2 emission from major sector.

15. (a) Explain the concept of carbon credit.

Or

(b) Discuss the role of individual to control CO_2 emission.

Part C

$(3 \times 10 = 30)$

Answer any **Three** questions.

16. Discuss the social and economic implications of energy utilization.

17. Explain the theory and practices for climate change.

18. Explain the theory of CO_2 emission related to energy conversion.

19. Discuss in detail about the methodology for CO_2 assessment.

20. Enumerate National and International policies for CO_2 emission.

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