M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Energy Science

BASIC ENERGY SCIENCES

(CBCS – 2019 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 2 = 20)

Answer **all** the questions.

1.   List the types of conventional energy resources.

2.   Mention the energy resources used in India.

3.   What is solar collector?

4.   Mention the importance of solar energy.

5.   What is wind farm?

6.   Write the criteria for selecting wind farms.

7.   How is bioenergy produced?

8.   List out the limitation of biogas plant.

9.   Define geothermal gradient.

10. What is tidal energy?

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

11. (a) Explain the benefits of energy conservation.

Or

(b) Discuss the different types of non-conventional energy resources.

12. (a) Compare the basic principle of Dye sensitized solar cells and perovskite solar cell.

Or

(b) Discuss about measurement of solar radiation.

13. (a) Discuss the different types of wind turbines used to extract wind energy.

Or

(b) Write the advantage and disadvantage of wind energy.

14. (a) Explain the production of ethanol from biomass.

Or

(b) Discuss biomass conversion system for waste to energy conversion.

15. (a) Write about geothermal power plant in India.

Or

(b) Mention the advantage and limitations of tidal energy.

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Answer any **three** questions.

16. Energy crises in India - discuss.

17. Explain in detail about flat plate and concentrating type solar collector.

18. Explain the method of storing wind energy and mention its limitation.

19. Discuss about classification and estimation of biomass.

20. What is tidal energy? Explain the types of tidal power plant.

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M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Energy Science

PHYSICS FOR ENERGY SCIENCES

(CBCS – 2019 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 2 = 20)

Answer **all** questions.

1.   Define Force.

2.   Why kinetic energy is scalar quantity?

3.   State second law of thermodynamics.

4.   What is Latent heat?

5.   Define Kirchhoff's voltage law.

6.   What is an electromotive force?

7.   What is superconductivity?

8.   What is Meissner effect?

9.   Name some radioactive materials?

10. Write briefly about properties of nuclei.

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

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

11. (a) State and explain Work — Kinetic energy theorem.

Or

(b) Differentiate conservative and non-conservative forces.

12. (a) Explain heat capacity and specific heat.

Or

(b) Discuss the applications of first law of thermodynamics.

13. (a) Discuss about resistors in series and in parallel.

Or

(b) Explain the working principle of transformer.

14. (a) Discuss the role of semiconductor in electrical conduction.

Or

(b) Write about free electron theory of metals.

15. (a) Describe the liquid drop model of nucleus.

Or

(b) Write about Breeder reactor.

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. What is conservative forces? Explain the relation between conservative force and potential energy.

17. Explain the thermal expansion of solids.

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R6048

18. Discuss the role of resistors, capacitors and inductors in an AC circuits.

19. Explain

    (a) Energy and spectra of molecules.

    (b) Band theory of solids. (5+5)

20. Explain in detail about nuclear reactors.

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R6048

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Energy Science

CHEMISTRY FOR ENERGY SCIENCES

(CBCS – 2019 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 2 = 20)

Answer **all** the questions.

1.   What is displacement reaction?

2.   Define Bronsted acids and bases.

3.   What is carbon compound?

4.   Define electronegativity.

5.   State Le Chatelier's principle.

6.   What is dynamic equilibrium?

7.   Write the criteria for spontaneity?

8.   What is enthalpy change?

9.   Mention the importance of buffer in chemical reactions.

10.   Mention any two application of electrolysis.

Part B (5 × 5 = 25)

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

11. (a) Write about metathesis reaction.

Or

(b) Explain the reactions of metals with acids.

12. (a) Differentiate ionic and covalent bond with an example.

Or

(b) Discuss about electronegativity and polarity of bonds.

13. (a) Explain the vapour pressure of liquids and solids.

Or

(b) Why gases are differ from liquids and solids? Explain.

14. (a) State and explain third law of thermodynamics.

Or

(b) Explain in detail Gibbs free energy.

15. (a) What is ionization constant for weak acids and bases?

Or

(b) Write a note on cell potential.

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Answer any **three** questions.

16. Explain the theories of acids and bases.

17. Discuss briefly the concept of resonance in acids and bases.

18. Explain the changes of state and dynamic equilibrium of liquids and solids.

19. Discuss briefly about factors affecting the rate of reaction.

20. What is Galvanic cell? How Galvanic cell is differing from electrolytic cell?

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M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Energy Science

POLYMER SCIENCE AND TECHNOLOGY

(CBCS – 2019 onwards)

Time : 3 Hours   Maximum : 75 Marks

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

Answer **all** the questions.

1. What are monomers and polymers? Give suitable examples.

2. Differentiate addition and condensation polymerization.

3. Give an example For Thermoplastic polymer.

4. What is copolymerization?

5. What is called filled plastics?

6. What is the role of additives in polymers?

7. Give an example for biodegradable polymers.

8. How to convert polymer into conducting polymer?

9. What is meant by thermoxidative degradation of polymer?

10. Write briefly about toxicity nature of polymers.

Part B (5 × 5 = 25)

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

11. (a) What are the types of Polymerization? Give an example.

Or

(b) Describe the mechanism of step-growth polymerization.

12. (a) Explain in detail about the polymer testing methods.

Or

(b) Discuss about the general properties of polymers.

13. (a) Differentiate polymer blend and polymer alloy.

Or

(b) Write a brief note on post fabrication operations.

14. (a) Mention the applications of polymers for space.

Or

(b) Write about biomedical polymers.

15. (a) Discuss the thermo-oxidative degradation of polymers.

Or

(b) Write about problems of polymer in energy and environment.

Part C (3 × 10 = 30)

Answer any **three** questions.

16. Explain the polymer process and its kinetics.

17. Discuss in detail about the structure and properties of polymer.

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18. Explain in detail about the fabrication techniques of polymer.

19. Discuss

    (a)   Bio-degradable polymers

    (b)   Non-linear optical polymers.   (5+5)

20. Describe the application of polymer in energy devices.

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R6050

R6051		Sub. Code
		540301

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Energy Science

HYDROGEN ENERGY SYSTEMS

(CBCS – 2019 onwards)

Time : 3 Hours   Maximum : 75 Marks

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

Answer **all** the questions.

1.   Mention the composition and uses of coal gas

2.   What are the main benefits of hydrogen fuel cells?

3.   Define the term gasification

4.   Name any two bacteria belonging to *Thermotogae* class

5.   What happens when water is electrolysed?

6.   What is meant by Photoelectrochemical (PEC) water splitting?

7.   Distinguish between acid and alkaline fuel cell

8.   Mention the advantages and disadvantages of fuel cells?

9.   What is the best way to store hydrogen?

10.   Mention the difficulties in storage and transportation of hydrogen gas

Part B (5 × 5 = 25)

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

11. (a) Discuss the processes of gas separation.

    Or

    (b) Write a note on membrane reactors.

12. (a) What is fermentation? Explain the production of hydrogen by fermentation.

    Or

    (b) Explain the role of sulphur in sulfidogenesis process.

13. (a) Write a note on photo-biochemical cells.

    Or

    (b) Describe the production of hydrogen in photovoltaic cells.

14. (a) Discuss the working of Micro fuel cell.

    Or

    (b) How is power generated in mobile and portable power generator.

15. (a) Write a note on underground hydrogen storage.

    Or

    (b) How is hydrogen stored using amine borane complexes?

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R6051

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Describe the preparation of hydrogen gas from various fuels

    (b) Explain the characteristics of steam reforming process.   (5+5)

17. Discuss the production of hydrogen from bacteria and carbon sources

18. Discuss the principle and working of (a) Tandem cell and (b) Photoelectrochemical cells.   (5 + 5)

19. Write short notes on (a) Phosphoric acid fuel cell (b) solid oxide fuel cells   (5 + 5)

20. Describe the storage of hydrogen using (a) clathrates and (b) carbon nanotubes.   (5 + 5)

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R6051

R6052	**Sub. Code**
	540302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Energy Science

WIND AND HYDRO ENERGY

(CBCS – 2019 onwards)

Time : 3 Hours   Maximum : 75 Marks

Part A   (10 × 2 = 20)

Answer **all** the questions.

1. What are the main types of wind energy?

2. Give the relationship between turbine size power ratings.

3. What are Onshore and offshore wind turbines?

4. Where can wind turbines be installed?

5. What is hydropower?

6. How is hydropower used in water mills?

7. What is wave tidal power?

8. What is importance of hydrology?

9. What are the different types of power plant?

10. What are the basic parameters to be considered while designing a power palnt?

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

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

11. (a) Explain the different types of propellers.

                    Or

    (b) Draw the neat diagram of wind turbine and explain the components involved in it.

12. (a) Write a note on wind farms.

                    Or

    (b) Discuss the planning and commissioning of wind farm designing.

13. (a) How are hydro power plants classified? Explain any one in detail.

                    Or

    (b) Explain micro hydro electric systems with a neat diagram.

14. (a) Distinguish between conventional power plant and pumped storage power plant.

                    Or

    (b) Write a note on Run-of-river water plant.

15. (a) What are the procedures to be followed to select the site for hydro power system?

                    Or

    (b) Discuss the initial and operation cost for designing a power plant.

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Part C (3 × 10 = 30)

Answer any **three** questions.

16. What is air density? How is it calculated for the moist air and dry air? How does it vary with humidity and pressure?

17. Describe the Challenges and development in wind power generation.

18. Discuss the working and applications of small hydropower systems.

19. (a) Compare the power generation of Run-of-river and tidal power plants.

    (b) Write a detailed notes on hydro power markets

    5+5.

20. Explain the environmental issues related to large hydro projects system.

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R6052

R6053	Sub. Code
	540303

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Energy Science

SOLAR THERMAL ENERGY

(CBCS – 2019 onwards)

Time : 3 Hours
Maximum : 75 Marks

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

Answer **all** the questions.

1. State two limitations of solar energy

2. What is solar radiation and insolation?

3. What is the most efficient thermodynamic cycle?

4. What are binary cycles give examples?

5. What are disadvantages of solar collectors?

6. Define solar flux unit

7. Mention the components present in the solar thermal system.

8. What is the advantage of solar thermal systems?

9. What are the economic impacts of solar?

10. Mention any two major companies manufacturing solar system

Part B (5 × 5 = 25)

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

11. (a) Using a neat diagram, explain the working of pyrheliometer

Or

(b) What are the factors effecting solar radiation?

12. (a) What is Carnot cycle? Explain it with neat diagram.

Or

(b) Describe the construction of Hybrid solar-gas power plant.

13. (a) Explain the different types of solar collectors.

Or

(b) Write a brief note on Flat plate collector.

14. (a) Explain the principle of solar thermal energy systems.

Or

(b) Distinguish between active and passive solar heating.

15. (a) Discuss the economical aspects of solar energy use.

Or

(b) Explain the electrical specification employed in solar panel.

2

R6053

Part C $(3 \times 10 = 30)$

Answer any **three** questions.

16. (a) Discuss the spectral energy distribution of solar radiation

 (b) Explain the characteristics of extraterrestrial radiation 5+5

17. Write short notes on

 (a) Stirling cycle

 (b) Brayton cycle

18. Describe the principle and construction of Evacuated tube collector with a neat diagram

19. Discuss the applications of solar thermal system

20. Describe the outlook and development potential of solar thermal power market

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R6054		Sub. Code
		540504

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Energy Science

ADVANCED INSTRUMENTAL METHODS OF ANALYSIS

(CBCS – 2019 onwards)

Time : 3 Hours   Maximum : 75 Marks

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

Answer **all** questions.

All questions carry equal marks.

1. What is atomic spectroscopy? Why it is needed?

2. What are the applications of Atomic Fluorescence Spectroscopy?

3. Write any two advantages of IR spectroscopy.

4. Define FTIR.

5. What do you understand by potentiometry?

6. What is CV measurement?

7. Define XPS.

8. Differentiate SEM and TEM.

9. What is thermal analysis?

10. What do you meant by DSC?

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

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

11. (a) Explain the working principle of Atomic Absorption Spectroscopy (AAS).

Or

(b) Discuss the different types of Fourier transforms.

12. (a) How FTIR differ from Raman spectroscopy? Explain.

Or

(b) Discuss in detail about SERS with appropriate sketch.

13. (a) List and explain the types of potentiometric titration.

Or

(b) Discuss in detail about pulse voltammetry.

14. (a) Write the working principle of X-ray Photoelectron Spectroscopy (XPS).

Or

(b) What are the applications and limitations of SEM?

15. (a) Differentiate differential thermal analysis (DTA) and differential Scanning Calorimetry (DSC).

Or

(b) Write a note on different methods of thermal analysis.

R6054

Answer any **three** questions.

16. List out the types of optical instruments. Explain the principles of Fourier transform optical measurements.

17. With suitable diagram explain the working, applications and limitations of Raman spectroscopy.

18. Explain the working of cyclic voltammetry with sketch. State the applications of cyclic voltammetry.

19. Write a note on

    (a) X-ray Diffraction (XRD)

    (b) Energy Dispersive X-ray Spectroscopy (EDAX)

20. Describe the construction, working and applications of Thermo Gravimetric Analysis (TGA).

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