R7700	Sub. Code
	540101

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Energy Science

BASIC ENERGY SCIENCES

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the questions.

1. Which is not an Petroleum Exporting Country

   (a) Algeria (b) Libya

   (c) Malaysia (d) Congo

2. Which one of the following energy resources is sufficient in India?

   (a) Petroleum (b) Coal

   (c) Natural gas (d) Geothermal

3. The energy in the photovoltaic effect is proportional to

   (a) Intensity (b) Frequency

   (c) Temperature (d) Humidity

4. Device converts solar energy to thermal energy is

   (a) LED (b) Flat plate collector

   (c) Photodiode (d) Photocathode

5. Nacelle is located in

(a) Top of turbine

(b) Bottom of turbine

(c) Middle of turbine

(d) None of the above

6. In wind turbines, Pitch is referred to as

(a) Twist of blade

(b) Rotation of blade

(c) Angular velocity

(d) Slow movement of wings

7. Which is the following is a character of clean fuel

(a) Pollution-free

(b) Non-renewable

(c) Generation of greenhouse gas

(d) Generation of lots of emissions

8. The popular name of biogas is

(a) Uranium (b) Petroleum

(c) Gobar gas (d) Diesel

9. How is Ocean Thermal Energy Conversion caused

(a) By wind energy

(b) By solar energy

(c) By geothermal energy

(d) By gravitational force

10. Which type of turbine is used in tidal energy?

(a) Pelton wheel (b) Kaplan turbine

(c) Gorlov turbine (d) Francis turbine

Part B (5 × 5 = 25)

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

11. (a) Sketch about non-conventional energy resources.

Or

(b) Discuss about India's energy scenario.

12. (a) Discuss about spectral energy distribution of solar radiation.

Or

(b) Provide information about solar concentrators.

13. (a) Mention the criteria for selecting the sites for wind farm.

Or

(b) Explain the classification of hydropower plants.

14. (a) Discuss about source and characteristics of Biofuels.

Or

(b) Explain the classification and estimation of biomass.

15. (a) List out the applications of geothermal energy.

Or

(b) Give the details about the tidal energy power plant.

Part C (5 × 8 = 40)

Answer any **five** questions.

16. Elucidate energy reserves and energy consumption in a worldwide approach.

17. Explain types of solar cells and Discuss briefly about DSSC.

18. Discuss Perovskite solar cells and photovoltaic conversion.

19. (a) Write about wind energy storage.

    (b) Discuss the potential of hydropower in India. (4+4)

20. What is bioethanol? Explain its preparation and applications.

21. Sketch India's bioenergy potential, plans and challenges.

22. (a) Give an account of geothermal energy in India.

    (b) Explain the types of tidal energy. (4+4)

23. (a) List out the advantages and disadvantages of tidal power.

    (b) List the advantages and disadvantages of geothermal energy. (4+4)

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R7701	Sub. Code
	540102

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Energy Science

CHEMISTRY FOR ENERGY SCIENCES

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. Molecules are held together in a crystal by

   (a) Hydrogen bond attraction

   (b) Electrostatic attraction

   (c) Van der Waal's attraction

   (d) Dipole-dipole

2. $p\pi - d\pi$ bonding is present in which molecule

   (a) SO_3^{2-} (b) CO_3^{2-}

   (c) NO_3^- (d) BO_3^{3-}

3. What is the product formed at the cathode in the electrolysis of molten NaCl?

   (a) Chlorine gas (b) Sodium metal

   (c) Hydrogen gas (d) Oxygen gas

4. Which of the following is the most powerful reducing agent?

(a) H_2S (b) H_2SO_3

(c) $SnCl_2$ (d) HNO_2

5. ———————— of thermodynamic is used to understand the concept of the energy conservation

(a) Zeroth Law (b) First law

(c) Second law (d) None of the above

6. The entropy of the universe is

(a) Continuously Increasing

(b) Continuously decreasing

(c) Zero

(d) Constant

7. Which of the following is not an example of an oxidizing agent?

(a) Hydrogen peroxide

(b) Potassium Dichromate

(c) Nitric acid

(d) Hydrogen sulfide

8. What is the number of electrons transferred in an equation if the Nernst equation is E(cell) =

(a) 2 (b) 6

(c) 4 (d) 1

9. Fluorescence occurs when the transition is

(a) Triplet-Triplet (b) Singlet-singlet

(c) Triplet-singlet (d) All of these

10. What will be the quantum yield when one mole of substance reacts by absorbing 6.022×10^{23} Photons

(a) 0.1 (b) 1

(c) 10 (d) zero

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

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

11. (a) Explain ionization potential and electron affinity.

Or

(b) Discuss the electronic configuration of heteronuclear diatomic modules.

12. (a) What is balancing Redox relation?

Or

(b) Explain electronegativity with an example.

13. (a) Write a short note on ideal gas and absolute temperature scales.

Or

(b) Discuss reversible and irreversible P-V works.

14. (a) What are reaction order and rate constants?

Or

(b) What are chain reactions?

15. (a) What is a quantum yield?

Or

(b) Explain photoluminescence.

Part C

$(5 \times 8 = 40)$

Answer any **five** questions.

16. Explain : dipole moment, lattice energy and electronic configuration of homonuclear diatomic modules.

17. Discuss hard and soft and bases.

18. Discuss standward potentials and standard reaction potentials.

19. Explain with an example of Batteries and Fuel Cells.

20. Derive Gibbs Helmholtz energies.

21. Explain Joule Thompson experiments.

22. Discuss in detail - Steady-state approximations.

23. Distinguish the assessment of $n-\pi^*$ and $\pi-\pi^*$ configuration.

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R7702	Sub. Code
	540103

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Energy Science

PHYSICS FOR ENERGY SCIENCES

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** questions.

1. Work is
   (a) Momentum transfer
   (b) Energy transfer
   (c) Time transfer
   (d) None of these
2. A man cleans the floor with a stick. It has a force 50N and makes the angle from the ground 30° If the stick is displaced 30 m to the right side, then the work done is
   (a) 120 J (b) 130 J
   (c) 110 J (d) 105 J
3. To protect electrical shock, the following setup is implemented
   (a) Ground fall circuit interruptions
   (b) Ceiling coli
   (c) Radio frequency oscillator
   (d) Water pump

4. When N1 < N2 it is referred to as

(a) Step up transformer

(b) Step down transformer

(c) Multi-coil transformer

(d) None of the above

5. A common thermometer uses one of the following substances

(a) Mercury or alcohol

(b) Liquid oxygen

(c) Liquid nitrogen

(d) Liquid helium

6. The value of the Boltzmann constant is

(a) 1.38×10^{-23} J/k (b) 1.28×10^{-23} J/k

(c) 1.38×10^{-32} J/k (d) 1.28×10^{-32} J/k

7. The atomic mass unit is the atomic mass of

(a) ${}_6C^{14}$ (b) ${}_6C^{12}$

(c) ${}_2He^4$ (d) ${}_7C^{14}$

8. The r_0 value in the nuclear radius will be

(a) 1.3 fm (b) 1.2 fm

(c) 1.4 fm (d) 1.8 fm

9. A pure crystal contains only one element or compound is called as

(a) Metal

(b) Insulator

(c) Intrinsic semiconductor

(d) Extrinsic semiconductor

10. Modelling constant depends upon

(a) Crystal bonds

(b) Crystalline temperature

(c) Crystalline structure

(d) Crystalline material

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

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

11. (a) Explain energy diagram and equilibrium of the system.

Or

(b) Derive work done by varying force.

12. (a) Determine the macroscopic description of an ideal gas.

Or

(b) Explain the celsius scale and constant volume thermometer.

13. (a) Elucidate resistors in a series circuit.

Or

(b) Mention resonance in the series circuit.

14. (a) Illustrate superconductivity and the Meissner effect.

Or

(b) Explain Vander wall and hydrogen bonding.

15. (a) Briefly discuss nuclear reactions and Q value.

Or

(b) Explain the nuclear fission process.

Part C

$(5 \times 8 = 40)$

Answer any **five** questions.

16. (a) What is kinetic energy?

    (b) Derive work kinetic energy theorem. (2 + 6)

17. Elaborate mass energy equivalence.

18. Explain second law of thermodynamics and heat engines.

19. Drive power in AC circuit.

20. Discuss RLC in the series circuit.

21. Derive the free electron theory of metals.

22. Discuss the design and construction of the nuclear reactor.

23. Explain α, β, γ decay and write down the uses of radiation.

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R7703	Sub. Code
	540104

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Energy Science

POLYMER SCIENCE AND TECHNOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

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

Answer **all** questions.

1. Which of the following monomers unsuitable for condensation polymerization?
   (a) Propionic acid and ethanol
   (b) Butane-dioic acid and glycol
   (c) Diamines and dicarboxylic acids
   (d) Hydroxy acids

2. Which of the following polymers are known for their high crystallinity?
   (a) Isotactic (b) Syndiotactic
   (c) Atactic (d) None of the mentioned

3. In addition polymer, the monomer used is
   (a) Unsaturated compounds
   (b) Saturated compounds
   (c) Bifunctional saturated compounds
   (d) Trifunctional saturated compounds

4. Which of the following does not undergo additional polymerization?

(a) Vinyl chloride

(b) Butadiene

(c) Styrene

(d) All of the above undergoes addition polymerizations

5. Why does polymers do not have a sharp melting point?

(a) Identical molecular weight

(b) No sharp melting crystals

(c) All of the mentioned

(d) None of the mentioned

6. What are the physical measurements which characterize nonpolymeric molecules?

(a) Freezing-point depressions

(b) Vapour pressures

(c) Boiling points

(d) All of the mentioned

7. Nylon threads are made of

(a) Polyester Polymer

(b) Polyamide Polymer

(c) Polyethylene Polymer

(d) Polyvinyl Polymer

8. The polymer used in making hair synthetic hair wigs is made up of

(a) $CH_2 = CHCl$ (b) $CH_2 = CHCOOCH_3$

(c) $C_6H_5CH = CH_2$ (d) $CH_2 = CH - CH = CH_2$

9. Which of the following is a thermosetting polymer?

(a) Polystyrene (b) Polyolefin

(c) Nylons (d) Phenolic resins

10. Which of the following polymer type is not classified on the basis of its application and properties?

(a) Rubbers (b) Plastics

(c) Fibers (d) Synthetic

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

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

11. (a) Explain the functionality of monomers.

Or

(b) Explain the types of polymerization.

12. (a) Write a note on multicomponent polymer materials.

Or

(b) Discuss about polymer reactors.

13. (a) Explain molecular weight determination of polymers.

Or

(b) Sketch thermal conductivity of the polymer.

14. (a) Write about conducting polymers.

Or

(b) Indicate bio-medical polymers.

15. (a) Explain fire hazards and thermoxidative degradation of polymers.

Or

(b) List out the application of polymers in tissue engineering.

Part C

$(5 \times 8 = 40)$

Answer any **five** questions.

16. Derive the mechanisms of free radical polymerization.

17. Elaborate on the structure of the polymer and its properties.

18. Explain compounding of polymer and polymer fabrication techniques.

19. Explain the molecular weight determination using light scattering centrifuge and viscosity method.

20. Discuss the thermal conductivity, melting point, softening point and shrinkage of polymers.

21. Write a note on conducting and magnetic polymers.

22. Explain about Biodegradable polymers.

23. Discuss the application of polymers in the energy, optical, electrical and drug industry.

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R7704	Sub. Code
	540501

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2022

First Semester

Energy Science

BIOFUELS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** questions.

1. Biomass is used in the production of
   (a) Fibers
   (b) Chemicals
   (c) Transportation fuels
   (d) Biochemicals
2. An example of starch crops biomass feedstock is
   (a) Corn stover
   (b) Wheat straw
   (c) Orchard pruning's
   (d) Sugar cane
3. Which of the following terms is most commonly used in the field of biomass?
   (a) Inorganic matter
   (b) Ammonium compounds
   (c) Chemicals
   (d) Organic matter

4. Which of the following does not serve as a source of biomass?

(a) Hybrid poplar (b) Trap grease

(c) Willow algae (d) Iron nails

5. Production of bioethanol is through fermentation of _____ and starch components.

(a) Alcohol (b) Sugar

(c) Milk (d) Acid

6. Bioethanol is denatured alcohol, also referred to as

(a) Ethylene (b) Ethylene glycerol

(c) Ethylene glycol (d) Methylated spirit

7. _____ can be utilized as a source of biodiesel.

(a) Animal skin (b) Animal teeth

(c) Animal bone (d) Animal fat

8. What is the primary source of biodiesel?

(a) Soya beans (b) Plant oil

(c) Animal fat (d) None of these

9. Which one is called as biogas?

(a) Biobutanol (b) Biodiesel

(c) Bioethanol (d) Biomethane

10. In biomethane, the percentage of carbon dioxide is

(a) 55 – 60 (b) 35 – 45

(c) 30 – 40 (d) 32 – 43

Part B (5 × 5 = 25)

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

11. (a) Derive the process of conversion of biomass to biofuel.

Or

(b) Explain the estimation of biomass.

12. (a) Define various generations of biofuels.

Or

(b) Discuss the extraction of biofuels from animal fat.

13. (a) Discuss the processing technologies of bioethanol and biobutanol.

Or

(b) Explain the needed materials of biobutanol.

14. (a) Elaborate the microorganisms used in the production of biodiesel.

Or

(b) Illustrate the purification of biodiesel.

15. (a) Briefly explain biogas plant.

Or

(b) Discuss the properties of biogas.

Part C (5 × 8 = 40)

Answer any **five** questions.

16. (a) Distinguish the advantages and disadvantages of biomass.

(b) Explain the application of remote sensing in forest assessment. (4 + 4)

17. Explain the economy of biofuels.

18. Explain the third generation biofuel with examples.

19. (a) What are feed stocks?

    (b) Determine the principles of biomethanol and biopropanol production. (4 + 4)

20. (a) Underline the current technologies of biodiesel production.

    (b) Write down about feed stocks prior to the biodiesel production. (4 + 4)

21. (a) Illustrate the industrial production of biodiesel.

    (b) Explain the advantages and disadvantages of feed stocks for biodiesel production. (4 + 4)

22. (a) Distinguish the advantages and disadvantages of biohydrogen.

    (b) Give an overview for biohydrogen production methods. (4 + 4)

23. Explain in detail : Fermentative hydrogen production.

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