R2007	Sub. Code
	540101

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Energy Science

BASIC ENERGY SCIENCES

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Energy in the form of heat and light is obtained by (CO1, K1)

   (a) Biomass (b) Fossil fuels

   (c) Sun (d) Wind

2. Energy resources derived from natural organic materials are called (CO1, K2)

   (a) Geothermal energy sources

   (b) Fossil fuels

   (c) Biomass

   (d) All of these

3. What type of solar collectors is commonly used for residential water heating systems? (CO2, K2)

   (a) Flat plate collectors

   (b) Solar concentrators

   (c) Parabolic trough collectors

   (d) Solar towers

4. What is the process of converting sunlight into electricity called? (CO2, K1)

(a) Photosynthesis (b) Solarization

(c) Solar panels (d) Photovoltaics

5. The blades in wind turbines are connected to ———— (CO3, K2)

(a) Nacelle (b) Tower

(c) Foundations (d) String

6. A wind turbine designed to come into operation at a minimum wind speed is called (CO3, K4)

(a) Cut in velocity (b) Windward

(c) Cut out velocity (d) Upwind location

7. Tn anaerobic digestion, biogas production by bacterial decomposition is (CO4, K1)

(a) Absence of oxygen

(b) Presence of oxygen

(c) Presence of CO_2

(d) Absence of CO_2

8. The aerobic digestion of sewage is used to produce ———— (CO4, K2)

(a) Biomass (b) Biofuels

(c) Synthetic fuels (d) Metal fuels

9. The annual depreciation of a hydropower plant is about (CO5, K2)

(a) 0.5% to l.5% (b) l0% to 15%

(c) 15% to 20% (d) 20% to 25%

10. What are the three ways to harness tidal energy? (CO5, K2)

(a) Tidal streams, tidal barrages. and wind

(b) Tidal barrages. wind and sun

(c) Tidal lagoons, river streams and geothermal reservoirs

(d) Tidal lagoons, tidal streams and tidal barrages.

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

Answer **all** questions not more than 500 words each.

11. (a) Explain primary and secondary energy sources. (CO1, K4)

Or

(b) Interpret the energy sources and their importance for sustainable development. (CO1, K4)

12. (a) Classify and briefly explain the different solar cells. (CO2, K2)

Or

(b) Discuss the challenges and prospects of solar photovoltaic systems for energy Generation. (CO2, K2)

13. (a) Outline the prospects of technologies for wind energy conversion. (CO3, K2)

Or

(b) Compare the environmental impacts of wind and hydro energy generation. (CO3, K2)

14. (a) Explain the process of converting biomass into biodiesel. (CO4, K6)

Or

(b) Elaborate the classification and estimation of biomass. (CO4, K6)

15. (a) Classify the main types of tidal energy. (CO5, K2)

Or

(b) Elaborate the applications of geothermal energy. (CO5, K2)

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1,000 words each.

16. (a) Compare the advantages and limitations of conventional and non-conventional energy resources. (CO1, K4)

Or

(b) Interpret the detailed overview of the global/Indian energy scenario. (CO1, K4)

17. (a) Explain the solar concentrators with a neat sketch and their applications. (CO2, K2)

Or

(b) Relate briefly about the following (CO2, K2)

(i) Dye-sensitized solar cells

(ii) Silicon solar cells.

18. (a) Classify the wind energy conversion systems and their advantages. (CO3, K2)

Or

(b) Discuss the environmental implications of different types of hydropower plants. (CO3, K2)

19. (a) Examine the types of biomass energy conversion systems briefly. (CO4, K6)

Or

(b) Elaborate the classification and estimation of biomass. (CO4, K6)

20. (a) Interpret the potential of geothermal energy in India and its prospects. (CO5, K2)

Or

(b) Compare the types of tidal power plants and explain the advantages and limitations. (CO5, K2)

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R2008	Sub. Code
	540102

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Energy Science

CHEMISTRY FOR ENERGY SCIENCES

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Which of the following is a characteristic of a strong acid? (CO1, K2)

   (a) It partially dissociates in water

   (b) It has a high pH value

   (c) It completely dissociates in water

   (d) It does not conduct electricity in solution

2. In molecular orbital theory, which of the following statements is true about bonding and antibonding orbitals? (CO1, K2)

   (a) Bonding orbitals have higher energy than antibonding orbitals

   (b) Antibonding orbitals are formed by constructive interference of atomic orbitals

   (c) Bonding orbitals increase the stability of the molecule

   (d) Electrons in antibonding orbitals increase the bond order

3. Which of the following factors directly influences the cell potential according to the Nernst equation? (CO2, K1)

(a) Temperature

(b) Concentration of reactants and products

(c) Number of moles of electrons transferred

(d) All of the above

4. In a galvanic (voltaic) cell, which of the following statements is true? (CO2, K2)

(a) The anode is the site of reduction

(b) Electrons flow from the cathode to the anode

(c) The anode is negatively charged

(d) The cell requires an external power source to operate

5. According to the First Law of Thermodynamics, which of the following equations correctly represents the principle? (CO3, K3)

(a) $\Delta U = QW$ (b) $\Delta U = Q + W$

(c) $\Delta U = Q - W$ (d) $\Delta U = W - Q$

6. Boyle's Law states that for a given amount of gas at constant temperature, the pressure and volume of the gas are (CO3, K1)

(a) Directly proportional

(b) Inversely proportional

(c) Unrelated

(d) Linearly proportional with a constant rate

7. Which of the following statements accurately describes the effect of increasing the concentration of reactants on the rate of a reaction? (CO4, K2)

(a) independent of the concentration of reactants

(b) increases linearly with the concentration of reactants

(c) increases with the concentration of reactants raised to the power of their respective order in the rate law

(d) decreases exponentially with the concentration of reactants

8. Thermal conductivity of a material measures (CO4, K2)

(a) rate at which heat is converted into work

(b) rate at which heat flows through the material

(c) rate at which heat is radiated from the material

(d) ability of a material to insulate heat

9. The process of a molecule absorbing light and undergoing a chemical change is known as: (CO5, K1)

(a) Photodissociation

(b) Photoreduction

(c) Photoionization

(d) Photolysis

10. Which of the following occurs when a substance emits light as a result of a chemical reaction? (CO5, K2)

(a) Phosphorescence

(b) Photoluminescence

(c) Chemiluminescence

(d) Fluorescence

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Explain the concept of hybridization and provide examples of hybridization in different types of molecules. (CO1, K3)

Or

(b) Using the Molecular Orbital diagram, determine the electronic configuration and bond order of hydrogen molecule. (CO1, K3)

12. (a) Explain the different types of cells for energy production and storage. (CO2, K3)

Or

(b) Describe the working principle of a battery with a neat diagram. (CO2, K3)

13. (a) Discuss the first law of thermodynamics. (CO3, K2)

Or

(b) State and explain the Maxwell relations relating enthalpy H, Helmholtz free energy F, internal energy U, and Gibbs free energy G. (CO3, K2)

14. (a) Briefly explain the temperature dependency of reaction rates. (CO4, K3)

Or

(b) Describe diffusion, effusion, and drift velocity in the context of chemical kinetics. (CO4, K3)

15. (a) Using two Jablonski diagrams, explain the absorbance of photon and fluorescence. (CO5, K4)

Or

(b) Differentiate between Photoluminescence and Chemiluminescence. (CO5, K4)

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

Answer **all** the questions not more than 1000 words each.

16. (a) List the bonding and non-bonding intermolecular forces and describe each in detail. (CO1, K3)

Or

(b) Discuss the difference between Lewis and Bronsted versus Arrhenius's theory using examples. (CO1, K3)

17. (a) Describe the components of an electrochemical cell and explain redox reaction during the electrochemical reaction. (CO2, K3)

Or

(b) Derive the Nernst equation to determine the extent of reaction between two redox systems. (CO2, K3)

18. (a) Describe in detail the cycle, principles, and efficiency of a Carnot engine. (CO3, K2)

Or

(b) State and derive Boyle's law to determine the relationship between the pressure and the volume of a gas. (CO3, K2)

19. (a) Derive the rate law using steady-state approximation. (CO4, K3)

Or

(b) Describe Einstein's relation (Stokes-Einstein equation) in the Kinetic theory of gases. explain its special cases. (CO4, K3)

20. (a) Explain the concept of singlet and triplet states in photochemistry. (CO5, K4)

Or

(b) Describe quantum yield in photochemical reactions and explain any two of its applications in detail. (CO5, K4)

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R2009	Sub. Code
	540103

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Energy Science

PHYSICS FOR ENERGY SCIENCES

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. If the velocity of a particle is reduced to half of its initial value, then the kinetic energy of the particle will _____ (CO1, K2)

   (a) Got doubled

   (b) Reduce to one – fourth of its original value

   (c) Reduce half of its original value

   (d) None of the above

2. Which energy is stored energy that depends upon the relative position of various parts of a system? (CO1, K2)

   (a) Mechanical energy

   (b) Kinetic energy

   (c) Potential energy

   (d) All of the above

3. In which process, heat observed or released by a system is zero? (CO2, K2)

(a) Isobaric process (b) Isothermal process

(c) Adiabatic process (d) None of the above

4. Heat engine is a device which convert ———— to ———— in a cyclic process. (CO2, K2)

(a) Mechanical energy, Heat energy

(b) Heat energy, Mechanical energy

(c) Mechanical energy, electrical energy

(d) None of the above

5. In a DC Circuit, Inductive reactance would be (CO3, K6)

(a) Equal as in AC Circuits

(b) High

(c) Extremely High

(d) Zero

6. Alternating current may be generated by a ———— (CO3, K6)

(a) Current (b) Dynamo

(c) Frequency (d) Self-induction

7. Which of the following is an amorphous solid? (CO4, K2)

(a) Manganese-alkaline

(b) Carbon-zinc

(c) Lithium

(d) Mercury

8. Battery charging equipment is generally installed? (CO4, K2)

(a) In well ventilated location

(b) In clean and dry place

(c) As near as practical to the battery being charged

(d) In location having all above features

9. Which is a measure of stability of any nucleus (CO5, K2)

(a) Quartz glass (b) Quartz

(c) Graphite (d) Salt (NaCl)

10. The best capable alternative source which can meet the future energy demand is ———— (CO5, K2)

(a) Thermal power plant

(b) Nuclear power plant

(c) Hydroelectric power plant

(d) Geothermal power plant

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Distinguish between kinetic and potential energy? (CO1, K2)

Or

(b) Write about the characteristics of kinetic energy? (CO1, K2)

12. (a) Define the following thermodynamic properties. (CO2, K2)

(i) Pressure,

(ii) Temperature,

(iii) Volume

(iv) Density

Or

(b) Explain zeroth law of thermodynamics? (CO2, K2)

13. (a) State and explain Kirchhoff's laws. (CO3, K6)

Or

(b) Write a note on electrical safety of using in day to day life? (CO3, K6)

14. (a) Explain properties of crystalline, polycrystalline and amorphous materials? (CO4, K2)

Or

(b) Express the Josephson's effect? (CO4, K2)

15. (a) Describe the following with suitable examples: (CO5, K2)

(i) Isotopes,

(ii) Isotones,

(iii) Isobars

Or

(b) Explain the principle of moderator and control rods with neat sketch. (CO5, K2)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Express about the conservative and non-conservative forces. (CO1, K2)

Or

(b) Discuss about the Quantization of energy and Plank's Contribution of this work. (CO1, K2)

17. (a) Describe about the thermal expansion of solids and liquids. (CO2, K2)

Or

(b) Explain the "First and Second law of Thermodynamics". (CO2, K2)

18. (a) Write the basic concepts of household wiring and explain. (CO3, K6)

Or

(b) Describe the construction details of single phase transformer. (CO3, K6)

19. (a) Explain the followings: (CO4, K2)

(i) Electron orbits

(ii) Molecular bonds

Or

(b) Describe about the classification of materials into conductors, semiconductors and Insulators. (CO4, K2)

20. (a) Briefly discuss about the Nuclear fission and fusion reaction. (CO5, K2)

Or

(b) Explain the working principle of Nuclear reactor with neat diagram. (CO5, K2)

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R2010	Sub. Code
	540104

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Energy Science

POLYMER SCIENCE AND TECHNOLOGY

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Polymer is ———— (CO1, K1)

   (a) A type of metal

   (b) A large molecule composed of repeating structural units

   (c) A form of renewable energy

   (d) A type of rock

2. Which factor does not affect the kinetics of polymerization reactions? (CO1, K2)

   (a) Temperature

   (b) Pressure

   (c) Concentration of reactants

   (d) Presence of impurities

3. Which of the following additives is commonly used to enhance the flame retardancy of polymers? (CO2, K2)

(a) Plasticizers (b) Stabilizers

(c) Fillers (d) Flame retardants

4. Which of the following kinds of polymer has the highest percentage in polypropylene? (CO2, K2)

(a) Syndiotactic (b) Isotactic

(c) Atactic (d) All of the mentioned

5. What is the primary building block of polymers? (CO3, K1)

(a) Monomer (b) Polymerase

(c) Catalyst (d) Polymerization

6. The chemical composition of a polymer can be analyzed by ———————— (CO3, K2)

(a) Nuclear magnetic resonance (NMR)

(b) Fourier-transform infrared spectroscopy (FTIR)

(c) Scanning electron microscopy (SEM)

(d) Atomic force microscopy (AFM)

7. The crystallinity of a polymer can be determined by ———— (CO4, K2)

(a) Differential scanning calorimetry (DSC)

(b) Fourier-transform infrared spectroscopy (FTIR)

(c) X-ray diffraction (XRD)

(d) Scanning electron microscopy (SEM)

8. Which type of polymer material is designed to break down naturally in the environment? (CO4, K3)

(a) Biodegradable (b) Conducting

(c) Magnetic (d) Nonlinear optical

9. Nylon threads are made of ———— (CO5, K1)

(a) Polyester polymer

(b) Polyamide polymer

(c) Polyethylene polymer

(d) Polyvinyl polymer

10. ———— is a thermosetting plastic (CO5, K2)

(a) PVC (b) Polythene

(c) Bakelite (d) Polystyrene

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

Answer **all** questions not more than 500 words each.

11. (a) Explain the Polymerization techniques with examples. (CO1, K2)

Or

(b) Summarize the Type of polymerization with a clear definition. (CO1, K2)

12. (a) Discuss the multicomponent polymeric materials and provide an example. (CO2, K2)

Or

(b) Explain the short note on polymer nanocomposites and their properties and applications. (CO2, K2)

13. (a) Express the density and bulk factor of polymer and its applications. (CO3. K3)

Or

(b) Explain the short note on the Weight and Viscosity average of polymers. (CO3, K3)

14. (a) Discuss the Biomedical polymers and their applications. (CO4, K2)

Or

(b) Summarize the Nonlinear optical polymers with clear examples. (CO4, K2)

15. (a) Outline the significance of polymers in drug delivery. (CO5, K2)

Or

(b) Discuss the Feedstock scarcity process and application of polymers. (CO5, K2)

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

Answer **all** questions not more than 1000 words each.

16. (a) Express briefly the Kinetics of the polymerization reaction and its mechanism. (CO1, K2)

Or

(b) Compare the addition polymerization and condensation polymerization. (CO1, K2)

17. (a) Outline the structure and properties of polymers, and provide clear examples. (CO2, K2)

Or

(b) Explain briefly the polymer processing and fabricating techniques. (CO2. K2)

18. (a) Discuss the Shrinkage behavior of polymers with a neat block diagram. (CO3, K3)

Or

(b) Illustrate the Molecular weight determination by light scattering method with a neat block diagram. (CO3, K3)

19. (a) Compare the conducting polymers and magnetic polymers, providing specific examples to illustrate their differences. (CO4, K2)

Or

(b) Explain the Biodegradable polymers: properties, Examples and benefits. (CO4, K2)

20. (a) Explain the Thermoxidative degradation of polymers with a neat diagram and its advantages, disadvantages. (CO5, K2)

Or

(b) Express the major role of polymers in Tissue engineering and water treatment applications. (CO5, K2)

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R2011	Sub. Code
	540501

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

First Semester

Energy Science

Elective – BIOFUELS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. Which of the following is NOT considered a biomass resource? (CO1, K1)

   (a) Agricultural residues

   (b) Forest residues

   (c) Animal manure

   (d) Coal

2. Which of the following is biofuels is derived from lipid-based biomass? (CO1, K1)

   (a) Bio methanol (b) Bioethanol

   (c) Biodiesel (d) Biogas

3. Third-generation biofuels are primarily derived from which of the following? (CO2, K2)

   (a) Algae (b) Corn

   (c) Animal fats (d) Sugar cane

4. Which feedstock is primarily used for producing biodiesel in first-generation biofuels? (CO2, K2)

(a) Soyabeans (b) Plant oil

(c) Animal manure (d) Palm oil

5. Ethanol refers to any biofuel made from (CO3, K1)

(a) Grass

(b) Corn

(c) Plant carbohydrates

(d) Leaves

6. Production of bioethanol is through fermentation of ———— and starch components. (CO3, K1)

(a) Alcohol (b) Sugar

(c) Milk (d) Acid

7. Which type of waste is primarily utilized in the production of biogas through anaerobic digestion? (CO4, K2)

(a) Plastic waste

(b) Organic solid waste and animal manure

(c) Metal waste

(d) Lignocellulosic waste

8. Animal fats and used cooking oils are commonly used in the production of which type of biofuel? (CO4, K1)

(a) Methylene (b) Ethylene

(c) Ethylene glycol (d) Biodiesel

9. Which process is primarily responsible for the production of biogas? (CO5, K1)

(a) Combustion

(b) Photosynthesis

(c) Anaerobic digestion

(d) Electrolysis

10. What is the main method of biohydrogen production using microorganisms? (CO5, K2)

(a) Pyrolysis (b) Fermentation

(c) Biomass (d) Combustion

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Elaborate the analytical techniques for biomass resource assessment. (CO1, K2)

Or

(b) List the advantages of biofuels using over fossil fuels. (CO1, K2)

12. (a) What are the updating initiatives regarding Biofuels? (CO5, K4)

Or

(b) Explain the second generation of bio fuels with example. (CO5, K4)

13. (a) Interpret the production of bioethanol. (CO3, K4)

Or

(b) Write down the properties of bio propanol and bio butanol. (CO3, K4)

14. (a) Elaborate the current technologies of biodiesel production. (CO4, K6)

Or

(b) Explain the steps involved in purification techniques of biodiesel. (CO4, K6)

15. (a) Determine the biological hydrogen production methods. (CO5, K5)

Or

(b) Compare the advantages and limitations of biohydrogen. (CO5, K5)

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Describe the methods used for biomass estimation and their importance in bioenergy production. (CO1, K2)

Or

(b) Explain the common techniques used for biomass resource assessment. (CO1, K2)

17. (a) How is gasification used in the production of biomethanol? (CO2, K4)

Or

(b) Explain the merits and demerits of biofuels. (CO2, K4)

18. (a) Discuss about the Hydrogen economy. (CO3, K4)

Or

(b) Compare the properties of bioethanol and bio methanal and explain its limits. (CO3, K4)

19. (a) Estimate the microorganisms and raw materials used for microbial oil production. (CO4, K6)

Or

(b) Describe the treatment of feed stocks prior to production of the biodiesel. (CO4, K6)

20. (a) Interpret the schematic mechanism of biogas production with neat sketch. (CO5, K5)

Or

(b) Determine the Fermentative hydrogen production methods. (CO5, K5)

———————

R2012	Sub. Code
	540301

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Energy Science

PHOTOVOLTAICS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The device that converts optical radiation into electrical energy is (CO1, K4)

   (a) LED (b) Photodetector

   (c) Solar cell (d) P-I-N diode

2. In an N-type doped semiconductor, the Femi level is (CO1, K4)

   (a) Closer to the conduction band edge

   (b) Closer to the valance band edge

   (c) Exactly at the middle of the bandgap

   (d) None of the above.

3. In modified chemical vapour deposition, vapour phase reactant such as ———————— pass through hot zone. (CO2, K2)

(a) Halide and Hydrogen

(b) Halide and Oxygen

(c) Halide and Silica

(d) Hydroxides and Oxygen

4. The manufacturing process of a solar cell is same as ———————— manufacturing process (CO2, K2)

(a) Memory chip

(b) Electronic devices

(c) Electrostatic devices

(d) None of the above.

5. What is the most commonly used materials for the transparent conducting oxide (TCO) layer in DSSC fabrication. (CO3, K3)

(a) TiO_2

(b) Indium doped SnO_2

(c) ZnO

(d) Fluorine doped SnO_2

6. What is the typical thickness range of the perovskite layer in PSC. (CO3, K3)

(a) 10-50 nm (b) 50-100 nm

(c) 100-500 nm (d) 500-1000 nm

7. Non-Identical photovoltaic cells are used in (CO4, K3)

(a) Series connections to increase voltage

(b) Parallel connection to increase current

(c) Both series and parallel connection to increase current and voltage

(d) None the above

8. Specify the name of the connector used to connect a solar panel array (CO4, K3)

(a) Ring Jugs

(b) Pin lugs

(c) Twisting of cables

(d) MC4 connectors

9. Which components is responsible for converting DC power to AC power in a grid connected system. (CO5, K4)

(a) Transformer (b) Rectifier

(c) Inverter (d) Generator

10. What is primary consideration for SPV power plant design in space (CO5, K4)

(a) Energy yield

(b) Weight and volume minimization

(c) Cost effectiveness

(d) Reliability.

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Explain and differentiate direct and indirect band gap. (CO1, K4)

Or

(b) Explain the diffusion and drift carriers for optical absorption. (CO1, K4)

12. (a) Describe the working principle of commercial silicon solar cell. (CO2, K2)

Or

(b) Briefly explain about plasma enhanced chemical vapour (PECVD) process. (CO2, K2)

13. (a) Discuss the advantage and disadvantages of organic solar cell (OSC). (CO3, K3)

Or

(b) Explain the concept of Tandem solar cells and its benefits. (CO3, K3)

14. (a) Elaborately discuss the PV module and its application. (CO4, K2)

Or

(b) Write the concept of module testing for Solar PV modules. (CO4, K2)

15. (a) Elucidate in detail about remote area power systems in an solar PV system. (CO5, K4)

Or

(b) Describe the role of Tele comnumication in solar PV system. (CO5, K4)

Part C (5 × 8 = 40)

Answer **all** the following questions not more than 1000 words each.

16. (a) Discuss in detail about principle and working of P-N junction Schottky diode with a neat diagram. (CO1, K4)

Or

(b) Explain in detail about anti-reflection coatings. (CO1, K4)

17. (a) What are the different types of silicon solar cell and explain it in detail. (CO2, K2)

Or

(b) Explain the process of chemical vapour deposition (CVD) method and list out benefits and challenges associated with it. (CO2, K2)

18. (a) Explain the working principle and fabrication of DSSC. (CO3, K3)

Or

(b) Discuss the working mechanism of Perovskite solar cells (PSC) and its types. (CO3, K3)

19. (a) Write a detailed account on PV module, module structuring and assembly. (CO4, K2)

Or

(b) What is solar PV modules?. Explain about identical and non-identical cells. (CO4, K2)

20. (a) Elaborately explain the module and array components of a photovoltaic (PV) system?(CO5, K4)

Or

(b) Explain about the following systems with neat diagram; (CO5, K4)

(i) Water Pumping.

(ii) Refrigeration.

———————

R2013	Sub. Code
	540302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Energy Science

ENERGY STORAGE SYSTEMS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The electrode for a battery must be (CO1, K1)

   (a) A semiconductor

   (b) An insulator

   (c) A good conductor of electricity

   (d) A bad conductor of electricity

2. Electrochemical cells convert (CO1, K2)

   (a) Mechanical energy into electrical energy

   (b) Potential energy into electrical energy

   (c) Kinetic energy into electrical energy

   (d) Chemical energy into electrical energy

3. An electrochemical cell is also called? (CO2, K2)

(a) Battery cell (b) Galvanic cell

(c) Cell (d) Chargeable cell

4. In a lead acid battery the energy is stored in the form of (CO2, K1)

(a) Charged ions

(b) Chemical energy

(c) Electrostatic energy

(d) Electromagnetic energy

5. Which of the following is the example of the electrolytes (CO3, K1)

(a) Acids (b) Metals

(c) Alloys (d) Oxides

6. Tn zinc-air cells are composed of three parts of zinc used as (C03, K2)

(a) Anode

(b) Cathode

(c) Based on the half cell

(d) Can't be said

7. Which is the most common type of super capacitor? (CO4, K2)

(a) Electric Double-layer Capacitor (EDLC)

(b) Pseudo capacitor

(c) Hybrid Capacitor

(d) All of the above

8. Fuel cells are (CO4, K1)

(a) Carbon cell (b) Hydrogen battery

(c) Nuclear cell (d) Chromium cell

9. A dead storage battery can be revived by (CO5, K2)

(a) Adding distilled water

(b) Adding so-called battery restorer

(c) A dose of H_2SO_4

(d) None of the above

10. Which medium capacitance is high? (CO5, K1)

(a) Air (b) Mica

(c) Water (d) Metal

Part B (5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Given a short note on Biological energy storage. (CO1, K2)

Or

(b) Compare the Electric energy and Thermal energy. (CO1, K2)

12. (a) Differences between the lead acid battery and sealed lead battery. (CO2, K6)

Or

(b) Briefly discuss sealed Lead Acid Batteries (SLA) and their charging, and discharging properties. (CO2, K6)

13. (a) Write the note on the fabrication of lithium-air battery. (CO3, K2)

Or

(b) Explain the design and operation of zinc air batteries. (CO3, K2)

14. (a) Discuss the Characterization of Bipolar Plates in Fuel Cells. (CO4, K6)

Or

(b) Short notes on fuel cells and their types. (CO4, K6)

15. (a) Draw a neat diagram of the battery/super capacitor hybrid system and explain it. (CO5, K2)

Or

(b) Define energy storage and its types. (CO5, K2)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Explain the energy storage and types of energy. (CO1, K2)

Or

(b) Compare Chemical energy and Biological energy with their advantages and disadvantages. (CO1, K2)

17. (a) Explain the construction and working principle of lead acid batteries with a neat diagram. (CO2, K6)

Or

(b) Illustrate the fabrication technologies of SLI batteries? Explain briefly? (CO2, K6)

18. (a) Difference between the metal air battery and lithium ion battery. (CO3, K2)

Or

(b) Briefly explain charging and discharging cycle of any one metal air batteries. (CO3, K2)

19. (a) Compare the advantages and disadvantages of precious and non-precious metal catalysts used in fuel cells. (CO4, K6)

Or

(b) Draw the neat diagram of Fuel cell stacks and systems and explain it. (CO4, K6)

20. (a) Explain the fundamentals and types of hybrid storage system. (CO5, K2)

Or

(b) Discuss about the Hybrid fuel cell/battery systems. Draw the neat diagram. (CO5, K2)

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R2014	Sub. Code
	540303

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Energy Science

ADVANCED INSTRUMENTAL METHODS OF ANALYSIS

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. The study of the interaction of electromagnetic radiation with matter called ————————. (CO1, K1)

   (a) Atomic spectroscopy

   (b) Molecular spectroscopy

   (c) Spectroscopy

   (d) Electromagnetic spectroscopy

2. Which spectroscopic technique is commonly used to analyze the functional groups in organic compounds? (CO1, K2)

   (a) Fourier transform infrared spectroscopy

   (b) Ultraviolet-visible spectroscopy

   (c) Raman spectroscopy

   (d) Ultraviolet photoelectron spectroscopy

3. Impedance analysis is used to study the ————————. (CO2, K1)

(a) Potential difference

(b) Current at a constant potential

(c) Electrical conductance

(d) Electrical properties of an electrochemical system

4. Coulometry technique used for ————————. (CO2, K2)

(a) Measuring the potential difference

(b) Measuring current at a constant potential

(c) Determining the mass of an analyte through electrolysis

(d) Monitoring changes in concentration over time

5. The crystal structure of materials is determined by ————————. (CO3, K2)

(a) X-ray Diffraction (XPD)

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

(c) Scanning Tunneling Microscopy (STM)

(d) Nuclear Magnetic Resonance Spectroscopy (NMR)

6. Which technique is used to visualize the surface morphology of materials at high magnification. (CO3, K2)

(a) Scanning Electron Microscopy (SEM)

(b) X-ray Photoelectron Spectroscopy (XPS)

(c) Nuclear Magnetic Resonance Spectroscopy (NMR)

(d) Mass Spectroscopy

7. ———————— technique is commonly used to measure a sample's weight changes as a function of temperature. (CO4, K2)

(a) Differential Scanning Calorimetry(DSC)

(b) Auger Electron Spectroscopy (AES)

(c) BET Surface Area Analysis

(d) Thermo Gravimetric Analysis (TGA)

8. Auger Electron Spectroscopy (AES) analysis used to analyze the ———————— of the materials. (CO4, K2)

(a) Surf topography

(b) Atomic concentration and chemical state

(c) Optical properties

(d) Magnetic properties

9. Interface phenomena in thin films refer to: (CO5, K1)

(a) The interaction between the film and its substrate

(b) The intrinsic properties of the film material

(c) The film's response to environmental changes

(d) The film's optical absorption

10. What are the primary types of charge carriers in semiconductors? (CO5, K1)

(a) Neutrons and protons

(b) Electrons and holes

(c) Photons and phonons

(d) Ions and dipoles

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Compare the atomic emission spectroscopy and flame emission spectroscopy. (CO1, K3)

Or

(b) Explain the significance of ultraviolet-visible spectroscopy and its applications. (CO1, K3)

12. (a) Explain the electro gravimetry process with merits and demerits. (CO2, K2)

Or

(b) Describe the working principles of voltammetry and polarography analysis. (CO2, K2)

13. (a) Express the construction, advantages, and disadvantages of AFM. (CO3, K3)

Or

(b) Explain the working principle of XRD and its applications. (CO3, K3)

14. (a) Outline the working principles of thermo gravimetric analysis (TGA). (CO4, K2)

Or

(b) Write a short note on Auger electron spectroscopy (AES) analysis. (CO4, K2)

15. (a) Differentiate between bulk and grain boundary capacitances. (CO5, K4)

Or

(b) Classify the thin film characterization techniques. (CO5, K4)

Part C (5 × 8 = 40)

Answer **all** the questions not more than 1000 words each.

16. (a) Briefly explain the atomic absorption spectroscopy and its applications, merits, and demerits. (CO1, K3)

Or

(b) Describe the Fourier transform infrared spectroscopy (FTIR) with a neat block diagram. (CO1, K3)

17. (a) Classify the main types of electroanalytical methods and their applications. (CO2, K2)

Or

(b) Explain the principles of impedance analysis and its significance in characterizing electrochemical systems. (CO2, K2)

18. (a) Describe SEM's construction, advantages, and disadvantages with a neat sketch. (CO3, K3)

Or

(b) Expalin briefly the working principle, advantages and disadvantages of NMR with a neat diagram. (CO3, K3)

19. (a) Compare the principles and applications of differential thermal analysis (DTA) and differential scanning calorimetry (DSC). (CO4, K2)

Or

(b) Discuss the principle of BET (Brunauer, Emmett, and Teller) surface area analysis technique and its applications. (CO4, K2)

20. (a) Interpret the Hall effect measurements and impedance spectroscopy in thin film analysis. (CO5, K4)

Or

(b) How do you characterize a thin film with Transmission Electron Microscope (TEM) with a neat sketch. (CO5, K4)

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R2015	Sub. Code
	540506

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2024

Third Semester

Energy Science

Elective – ENERGY AUDIT AND MANAGEMENT

(CBCS – 2022 onwards)

Time : 3 Hours Maximum : 75 Marks

Part A (10 × 1 = 10)

Answer **all** the following objective questions by choosing the correct option.

1. What is the primary objective of energy management? (CO1, K1)

   (a) Increase energy consumption

   (b) Optimize energy use and reduce costs

   (c) Ignore energy efficiency

   (d) Focus solely on renewable energy sources

2. Which skill is essential for effective energy management? (CO1, K2)

   (a) Data analysis

   (b) Graphic design

   (c) Public speaking

   (d) Event planning

3. Which of the following is a type of energy audit? (CO2, K1)

(a) Preliminary audit

(b) Detailed audit

(c) Investment-grade audit

(d) All of the above

4. What is fuel and energy substitution? (CO2, K1)

(a) Replacing one type of fuel with another to improve efficiency

(b) Ignoring alternative energy sources

(c) Increasing reliance on fossil fuels

(d) Reducing energy consumption without analysis

5. What is a requirement for effective energy action planning? (CO3, K2)

(a) Lack of data analysis

(b) Clear goals and measurable objectives

(c) Ignoring stakeholder engagement

(d) Focusing only on past performance

6. What is a common barrier to effective energy policy implementation? (CO3, K1)

(a) Strong leadership support

(b) Lack of employee awareness and training

(c) Comprehensive information systems

(d) Clear communication strategies

7. What does the First Law of Efficiency state? (CO4, K1)

(a) Energy cannot be created or destroyed, only transformed

(b) Energy can be created from nothing

(c) Energy efficiency is irrelevant

(d) Energy is always lost in a system

8. Which of the following is a key benefit of using an Energy Balance and MIS? (CO4, K2)

(a) Increased energy waste

(b) Enhanced decision-making through data-driven insights

(c) Reduced employee engagement

(d) Ignoring energy efficiency measures

9. Which of the following is a common type of energy audit instrument? (CO5, K1)

(a) Thermocouple

(b) Energy management software

(c) Power meter

(d) All of the above

10. What type of instrument is used to measure electrical power consumption? (CO5, K1)

(a) Anemometer

(b) Power meter

(c) Infrared thermometer

(d) Lux meter

Part B (5 × 5 = 25)

Answer **all** the questions not more than 500 words each.

11. (a) Write the general Philosophy and Need of Energy Audit and Management. (CO1, K2)

Or

(b) Explain an essential elements of an effective energy management strategy. (CO1, K2)

12. (a) Write a short note on (CO2, K2)

(i) Benchmarking

(ii) Energy Performance.

Or

(b) Distinguish between the preliminary energy audit and detailed energy audit. (CO2, K2)

13. (a) Explain how energy audits and monitoring systems are used to inform energy action plans. (CO3, K4)

Or

(b) How does the role of the energy manager influence the overall energy efficiency of an organization? (CO3, K4)

14. (a) Explain about the materials and Energy balancediagram with detail. (CO4, K3)

Or

(b) What is the difference between first law and second law efficiency in energy systems? (CO4, K3)

15. (a) What are the types and accuracy of the Energy Audit Instrument? (CO5, K2)

Or

(b) List the instruments used in energy auditing and explain their functions. (CO5, K2)

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

Answer **all** the questions not more than 1000 words each.

16. (a) Discuss the steps involved in Energy's Management Strategy. How it can be improved? (CO12, K2)

Or

(b) Explain Energy Management. What are the objectives of Energy Management? (CO1, K2)

17. (a) Explain the environmental and economic benefits of implementing energy management strategies within an organization. (CO2, K2)

Or

(b) Explain an optimizing the input energy requirement and increase efficiency. (CO2, K2)

18. (a) Explain brief with examples on fuel and energy substitution. (CO3, K4)

Or

(b) Discuss the accountability mechanisms in place for energy managers. How do they ensure adherence to energy policies and targets? (CO3, K4)

19. (a) What are the potential trade-offs when implementing energy efficiency improvements? (CO4, K3)

Or

(b) Identify that how Sankey diagram is useful in energy balance calculations. (CO4, K3)

20. (a) Explain the importance of energy savings and how accurate measurement plays a role in it. (CO5, K2)

Or

(b) Describe different types of errors that affect the accuracy of energy auditing instruments. (CO5, K2)

———————