SAMPLE PAPERS

DIPLOMA FIFTH SEMESTER EXAMINATION 2025 (JUT)

RENEWABLE ENERGY TECHNOLOGY

DIPLOMA WALLAH

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Full Marks: 7 marks 0 | Time: 3 Hours

Instructions:

- Question No. 1 is compulsory.
- Answer any **FOUR** questions from the remaining (Q.2 to Q. 7 marks).

Q.1 Multiple Choice Questions (Compulsory) [2 × 7 = 14]

(i) The value of the Solar Constant is approximately:

(a) 1000 W/m²

(b) 1367 W/m²

(c) 1500 W/m²

(d) 2000 W/m²

(ii) Which instrument is used to measure Beam (Direct) Radiation only?

(a) Pyranometer

(b) Pyrheliometer

(c) Sunshine Recorder

(d) Anemometer

(iii) The theoretical maximum efficiency of a wind turbine (Betz Limit) is:

(a) 100%

(b) 80%

(c) 59.3%

(d) 45.5%

(iv) In a Fuel Cell, chemical energy is converted into:

(a) Mechanical Energy

(b) Heat Energy only

(c) Electrical Energy

(d) Magnetic Energy

(v) The main constituent of Biogas is:

(a) Methane (CH_4)

(b) Carbon Dioxide (CO_2)

(c) Hydrogen (H_2)

(d) Nitrogen (N_2)

(vi) Which of the following is a type of Geothermal Power Plant?

(a) Fixed Dome Type

(b) Binary Cycle Type

(c) Horizontal Axis Type

(d) Focusing Type

(vii) Tidal energy is primarily caused by:

(a) Wind speed

(b) Solar heat

(c) Gravitational pull of the Moon

(d) Ocean salinity

Q.2

(a) Draw the Block Diagram of a basic Photovoltaic (PV) System for power generation and explain the function of each component (Array, Battery, Inverter, Charge Controller). [7 Marks]

(b) Draw the Equivalent Circuit of a Solar Cell and explain its I-V (Current-Voltage) characteristics curve. [7 Marks]

Q.3

(a) Explain the construction and working principle of a Flat Plate Collector (FPC) with a neat diagram. [7 Marks]

(b) Differentiate between Pitch Control and Yaw Control in a wind turbine system. [7 Marks]

Q.4

(a) Draw the Block Diagram of a Wind Energy Conversion System (WECS) and explain the working of its main components (Rotor, Gearbox, Generator). [7 Marks]

(b) Explain the working principle of a Doubly-Fed Induction Generator (DFIG) used in wind turbines. [7 Marks]

Q.5

(a) With a neat schematic diagram, explain the construction and working of a Fixed Dome type (Chinese Digester) Biogas plant. [7 Marks]

(b) Explain the various Biomass Conversion Processes (Anaerobic Digestion, Fermentation, Pyrolysis, and Gasification). [7 Marks]

Q.6

(a) Explain the working principle, construction, and chemical reactions of a Hydrogen Fuel Cell. [7 Marks]

(b) Explain the working principle of a Geothermal Power Plant (Dry Steam or Binary type) with a diagram. [7 Marks]

Q.7 Write Short Notes on (Any FOUR): [3.5 × 4 = 14]

(a) Factors affecting Biogas generation

(b) Hydrogen Storage methods

(c) Site selection for Wind Power Plant

(d) Ocean Thermal Energy Conversion (OTEC)

(e) Difference between Focusing and Non-focusing Collectors

SOLUTIONS FOR PAPER - 1

MCQ Answers:

(i) b, (ii) b, (iii) c, (iv) c, (v) a, (vi) b, (vii) c

Brief Hints for Theory:

- **Q2(a):** Draw blocks: Solar Panel -->Charge Controller -->Battery -->Inverter -->Load. Explain that Inverter changes DC to AC.
- **Q2(b):** Draw circuit with current source, diode, resistor. Graph: Current on Y-axis, Voltage on X-axis, "Knee" point is max power.
- **Q3(a):** Diagram must show: Glass cover, Absorber plate, Tubes, Insulation, Box. Principle: Greenhouse effect traps heat.
- **Q3(b): Pitch:** Changing blade angle to control speed. **Yaw:** Rotating tower head to face wind direction.
- **Q5(a):** Diagram: Underground brick tank, Mixing tank, Outlet tank. Gas collects in dome, pressure pushes slurry out.
- **Q7(a):** Temp (30-35°C best), pH (6.8-7.2), Retention time, C/N ratio.