

Seat No./Enrollment No.: _____

GUJARAT TECHNOLOGICAL UNIVERSITY
BACHELOR OF ENGINEERING – SEMESTER 7 – EXAMINATION – SUMMER 2026

Subject Code: 3170116

Date: 03/06/2026

Subject Name: Solar and wind Energy

Time: 02:30 PM TO 05:00 PM

Total Marks: 70

Instructions:

- 1. Attempt all questions.**
- 2. Make suitable assumptions wherever necessary.**
- 3. Figures to the right indicate full marks.**
- 4. Simple and non-programmable scientific calculators are allowed.**

- Q.1**
- (a)** State the advantages and limitations of renewable energy sources. **03**
 - (b)** Define solar constant and spectral distribution. **04**
 - (c)** With a neat sketch, explain the working principle of a solar liquid flat plate collector **07**
- Q.2**
- (a)** List the utility of solar pond, solar still and solar dryer. **03**
 - (b)** Define the following terms: solar constant, hour angle, solar declination, zenith angle. **04**
 - (c)** Write a note on different instruments used for solar radiation measurement with neat sketches. **07**
- OR**
- Q.2**
- (c)** With a neat sketch explain the advantages, disadvantages and working of a Box type solar cooker. **07**
- Q.3**
- (a)** Define tilt angle. What is the importance of tilt angle in solar radiation measurement? **03**
 - (b)** What is the Betz limit? Give its significance. **04**
 - (c)** Explain the present energy scenario of conventional and renewable energy sources in India **07**
- OR**
- Q.3**
- (a)** Define: Terrestrial radiation, Extra terrestrial radiation, Beam radiation **03**
 - (b)** Explain payback period and life cycle cost analysis, annual cost and cumulative cost. **04**
 - (c)** Explain the design and working of a solar air heater and list factors affecting its performance. **07**
- Q.4**
- (a)** Define: tip speed ratio and solidity for wind turbines. **03**
 - (b)** Explain the effect of air density, wind speed, and angle of attack on wind turbine output. **04**
 - (c)** Derive and explain the Betz limit for maximum power extraction from wind. **07**
- OR**
- Q.4**
- (a)** List the components of the wind turbine power plant. **03**

(b) Compare horizontal and vertical axis wind turbines with neat diagrams. **04**

(c) Discuss wind energy potential and site selection criteria for wind farm installation. **07**

Q.5 (a) Explain the working of solar refrigeration system. **03**

(b) At a wind turbine site, wind velocity is 10 m/s. Calculate following for air at standard atmospheric pressure and 15°C temperature: **04**

1. Total power density in wind stream
2. Maximum obtainable power density

Standard atmospheric pressure is 101.325 kPa and characteristic gas constant for air is 0.287 kJ/kg K

(c) A propeller wind machine has a rotor diameter of 60 m. It is operating at a location having a wind speed of 35 kmph and rotating at 20 rpm. Calculate theoretically the power which the machine can extract from the wind if (a) only wake rotation is considered (b) both wake rotation and the effects of the drag are considered. Value of drag to lift coefficient may be taken as 0.012. Density of air is 1.2 kg/m³. **07**

OR

Q.5 (a) Differentiate the concentrating and non concentrating type solar collectors. **03**

(b) Explain the working principle and applications of a photovoltaic (PV) cell and its types. **04**

(c) Describe the working of Solar Passive Space heating and cooling with sketch. **07**
