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Sardar Patel University

M.Sc. Renewable Energy

Semester : First

Course Code: PS01EREN01

Course Title: Wind Energy

Date: Saturday, 29.10.2016

Time: 10:00 AM to 1:00 PM

Total Marks: 70

Note: **1. All the questions are compulsory**
2. Figures on the right bracket indicated marks

Que. 1: Choose the correct answer **9 Marks**

i. Wind turbine uses ..... in the wind.
   a. Kinetic Energy
   b. Chemical Energy
   c. Potential Energy
   d. Thermal Energy

ii. Maximum theoretical efficiency of wind turbine is .....
   a. 59 %
   b. 65 %
   c. 45 %
   d. 35 %

iii. Pitch angle for propeller type wind mill is .....
   a. 0-25°
   b. 10-18°
   c. 0-30°
   d. 5-15°

iv. The ..... force is responsible for rotation of the aerofoil.
   a. Drag Force
   b. Pneumatic force
   c. Lift Force
   d. None of above

v. In synchronous type generator, synchronous speed is given by .....
   a. Ns= 120 f/p
   b. Ns=180 p/f
   c. Ns=120 p/f
   d. Ns=180 f/p

vi. The wind velocity at which the wind turbine comes into operation is called .....
   a. Cut out velocity
   b. Cut in velocity
   c. Power coefficient
   d. Variable velocity

vii. ..... type wind mill is most popular wind turbine system
   a. Savonius Rotor
   b. Vertical Axis
   c. Two blade propeller
   d. Three blade propeller

viii. A term used to represent all the revenues minus the money invested and all the cost during the life of the project converted to today's money is called as .....
   a. Compound interest
   b. Net present value
   c. Initial cost
   d. future value

ix. Offshore wind energy installation is in .....
   a. In the sea water
   b. On terrain
   c. On the shore
   d. On the hills

Que. 2: Answer any seven short questions (each carry 3 marks) **21 Marks**

i. Explain in brief horizontal axis multi blade wind turbine with suitable diagram
ii. Explain in brief teethering control, yaw control
iii. Explain the nature and origin of wind
iv. Give criteria for selection of wind farm
v. Explain with figure -twin blade horizontal axis wind turbine
vi. Give advantages, disadvantages and application of mono blade HAWT
vii. What are the objectives of offshore wind energy policy of India?
viii. With an annual interest rate of 8%, determine the future value of Rs. 15 million invested after 5 years. The interest rate is compounded every 6 months.
ix. Write short note on Savonious wind turbine.
x. Give the development and maritime zones of offshore wind energy in India

Que. 3: A) Give merits and demerits of wind energy conversion in details **5 Marks**

B) Derive the expression for the forces acting on the blade of propeller type wind turbine **5 Marks**

OR

A horizontal shaft, propeller type wind turbine is located in area having the following wind characteristic: speed of wind 10 m/s, and 15 °C. Calculate following-

a. Air Density, ρ
b. Total power density in wind stream, W/m^2
c. Maximum obtainable power density, W/m^2
d. Actual obtainable power density, W/m^2
e. Total Power from wind turbine of 120 m dia.
Torque and axial thrust, at turbine operating speed 40 rpm and maximum efficiency 42%

Que. 4: A) Explain three blade horizontal axis wind turbine with suitable diagram in details **5 Marks**

B) Explain vertical axis Darrieus rotor wind turbine generator with suitable figure **5 Marks**

OR

Explain the ideal P-V characteristics of wind turbine rotor with suitable diagram

Que. 5: A) Explain different initial costs included in wind turbine projects in brief. **5 Marks**

B) Explain with suitable diagram **5 Marks**

i. Constant speed constant frequency system
ii. Variable speed constant frequency system

OR

Explain with suitable diagram

i. Wind turbine generator unit with battery storage
ii. Solar wind hybrid system

Que. 6: A) State the difference between offshore wind turbine and onshore wind turbine **5 Marks**

B) Give the detailed advantages and disadvantage of offshore wind turbine **5 Marks**

OR

What are the elements of development offshore wind energy in India?