Registration No: | | | | | | | | | | |

Total Number of Pages: 02 **M.TECH**

P1EEBC05,P1ELBC05

1st Semester Regular Examination 2016-17
SMART ELECTRICAL ENERGY SYSTEM
BRANCH: ELECTRICAL ENGG.
Time: 3 Hours
Max Marks: 100
Q.CODE: Y976

Answer Question No.1 which is compulsory and any FOUR from the rest.
The figures in the right hand margin indicate marks.

Q1 Answer the following questions: ***Short answer type*** **(2 x 10)**

a) Define the term solar altitude angle.

b) Determine the available power output from wind turbine when Blade length= 52m, wind speed=12m/s, air density= 1.23kg.m^3 and power coefficient is 0.4.

c) Highlight the issues and functions of smart grid

d) A semiconductor is doped with a 10^{15} P atoms/cm^3. What will be the electron concentration in the material?

e) What are the different types of rotors used in wind power generators?

f) Difference between smart grid and micro-grid.

g) Draw the layout of wind mill connected to grid.

h) A generating station has connected load of 450 MW and a maximum demand of 250 MW, units generated being 615*10^6 per annum. Calculate the demand factor and load factor.

i) Calculate the fill factor for a solar cell which has the following parameters: V_{oc}=0.24 V, I_{sc}=-9 mA, V_{max}=0.14 V, I_{max}=-3 mA

j) What is Distributed Generation? State the principle of DG power plant.

Q2 **a)** **i)** For an 8 – blade wind turbine, calculate the angular speed of the rotor to lift water from 6-m depth if the radius of the turbine rotor is 1m and the wind speed is 10 m/s. **(5+5)**

Assume λ=1.

ii)A HAWT has the following data:
Speed of wind = 10 m/s at 1 atm and 15^{0}C
Diameter of rotor = 120 m
Speed of rotor = 40 rpm
Calculate the maximum possible torque produced at the shaft

b) Explain with a neat diagram the working of various types of wind generators. **(10)**

Q3 **a)** **i)**Explain how Smart Appliances can be the part of Smart Grid. **(5+5)**

ii) What is grid interfacing and how can the grid connection be made possible?

b) Explain the Resilient and self healing grid. **(10)**

Q4 **a)** Explain how Smart Meters can be play an important role to make a system Smart. **(10)**

b) Write a note on present development in Smart Grid considering any one case study. **(10)**

Q5 **a)** Compute the monthly average hourly solar flux received on a flat plate collector facing due south having a slope of 12.5^0 . The collector is placed at a place 15^0 North on 20^{th} day of October. Consider the following data: **(10)**

H_g= 2405 kJ/m^2/h,
H_d= 1075 kJ/m^2/h,
Ground reflectivity, ρ =0.25 , ω=7.5^0.

b) **i)**Estimate the monthly average daily global radiation on a horizontal surface at Vadodara (22o00'N,73o10'E) during the month of march if the average sunshine hours per day is 10 . **(5+5)**
A=0.28 and b=0.48 for vadodara.

$$H_0 = \frac{24}{\pi} I_{SC} \left(1 + 0.033\ COS\frac{360n}{365}\right)(w_s sin\varphi sin\delta + cos\varphi cos\delta sinw_s)$$

ii) Why solar collector is used. Write the various characteristics of solar collector.

Q6 **a)** Explain the specific wind turbine performance calculations. **(10)**

b) **i)** Explain the effect of distributed generation system in power system operation. **(5+5)**
ii) A generating station supplied the following loads : 150 MW, 120 MW, 85 MW, 60 MW,5 MW. The station has a maximum demand of 220 MW. The annual load factor of the station is 48%. Calculate : 1) the number of units supplied annually 2) diversity factor 3) demand factor

Q7 Write notes on any two: **(5+5)**
i)Role of charge controller in PV system
ii) Torque –Speed characteristics of wind turbines.
iii) Power quality management in smart grid
iv) Concept of Distributed Generation

b) Derive the expression for voltage variation in conventional distribution network **(10)**