MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
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VII SEMESTER B.TECH (ELECTRICAL & ELECTRONICS ENGINEERING)
PROCTORED ONLINE MAKEUP EXAMINATIONS, FEBRAUARY 2022

RENEWABLE ENERGY [ELE 4086]

REVISED CREDIT SYSTEM

Time: 75 Minutes + 10 Minutes **Date: 22 February 2022** **Max. Marks: 20**

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data may be suitably assumed.
- Time: 75 minutes for writing + 10 minutes for uploading.

1A. Derive the mathematical modeling for I-V characteristics of a practical photovoltaic cell with the help of single diode model. Draw the I-V and P-V characteristics of a PV cell for two different insolation and temperature conditions.

If a solar cell ($225cm^2$) receives solar radiation with photons of 1.8 ev energy having an intensity of $90\,mW/cm^2$. Measurements show open circuit voltage $2.666mV/cm^2$, short circuit current of $40\,mA/cm^2$ and the maximum current (I_{MPP}) is 90% of the short circuit current. The efficiency of the cell is 20%. Calculate the maximum voltage (V_{MPP}) that the cell can operate and find the "Fill Factor". Also, comment on the quality of the above said PV cell. ***(03)***

1B. Define power coefficient in Wind Energy conversion System and prove that its maximum value is 59%. Also, compare the two wind turbines having different axial interference factors. ***(04)***

1C. Design a standalone distributed energy system comprising of Renewable Energy sources with the following specifications: Load profile parameters: $\boldsymbol{P_{dem,\,min} = 1\ MW, P_{dem,\,max} = 9\ MW,}$ $\boldsymbol{\bar{P}_{dem} = 6\ MW;}$ $\boldsymbol{K_{cf\_wtg}}$ =16%, $\boldsymbol{K_{cf\_PV}}$ =10% are the capacity factors of wind turbine generator and Photovoltaic system respectively. Assume that the system is operating with photovoltaic, wind energy conversion system and battery bank as an energy storage.

i) If $\boldsymbol{P_{PV,\,rated}} = 20\,MW$, what should be the rated power of Wind energy conversion system (WECS)?

ii) For the generation of the rated power from WECS, how many 1000 kW wind turbine generator units are required?

iii) What is the maximum possible excess power generated by considering the given capacity? ***(03)***

2A. Describe the extraction of power using binary cycle system in geothermal power plant with a neat diagram. ***(03)***

2B. Compare & discuss the double basin linked basin plant & double basin paired basin tidal plant with a neat diagrams ***(04)***

2C. Compare & discuss the continuous & batch type biogas plants with a neat diagrams ***(03)***