

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)**

**CLASS: M.Tech.
BRANCH:EE : EEE**

**SEMESTER : SP2022
SESSION : 2021-22**

SUBJECT : EE605 MICROGRID OPERATION AND CONTROL

TIME : 2 HOURS

FULL MARKS : 50

INSTRUCTION :

- 1. The question paper contains 12 questions.**
- 2. The first question is mandatory to answer and candidates may attempt any 9 questions from the rest 11 questions. Two marks are allotted to each question given under question 1 and four marks are allotted to each of the rest questions.**
- 3. The missing data, if any, may be assumed suitably.**
- 4. Before attempting the question paper, be sure that you have got the correct question paper.**
- 5. Tables/Data hand book/Graph Paper etc. to be supplied to the candidates in the examination hall.**

1. Write the answers of the following questions in brief and without any block diagram
 - (a) "Grid feeding inverter can not operate in island mode" -Justify
 - (b) "P/f and Q/V will be failure for resistive grid"-Justify
 - (c) " Secondary Control compensates the steady state errors in the microgrid voltage and frequency" Justify
 - (d) What is 4 percent droop in actual values(Hz/MW). Consider the rated capacity of the unit is 50 MW and nominal frequency is 50 Hz.
 - (e) 'Droop meets the load at lower frequency'-Justify
 - (f) 'Control to DC to DC converter is required to achieve MPPT for SPV"-Justify
 - (g) "Only RES integration in distribution system may not be always called as Microgrid"-Justify
2. What is the basic structure (block diagram) of grid forming voltage source inverter? What is the purpose of current controller used in the block diagram?
3. Draw the block diagram showing the implementation of droop controller in dq reference frame for power dispatching.
4. Discuss the importance of virtual impedance based droop and show the changes in the voltage control loop (need not to draw the whole diagram).
5. Draw a block diagram that shows inverter control by primary, secondary and tertiary control.
6. Derive state space equation of islanded microgrid considering a PV source which is working on MPPT mode (not depending on changing frequency), a diesel generator (controllable with frequency) and a battery energy storage.
7. What do you mean by Non detection zone with one example related to islanding?
8. Draw the equivalent electrical diagram of battery energy storage and then write the equation for duty cycle ratio. How can we assign battery reference current?
9. Draw the equivalent electrical diagram of complete PV based system that includes PV, ESS, DC link capacitor, Inverter and grid.
10. There are different operating modes as per IEEE standard like 'no ride through', 'continuous operation', 'mandatory operation' while the unit is on frequency ride-through. Define these operating modes.
11. There are different reactive power control functions like Constant reactive power mode, voltage-reactive power mode etc. Discuss any one mod with example.
12. Discuss in brief the different objectives and strategies of Microgrid operation.