Total No. of Questions:4]

SEAT No. :

PC207

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B.E. (Electrical Engineering) (Insem)

POWER SYSTEM OPERATION AND CONTROL

(2019 Pattern) (Semester-VII) (403141)

Time : 1 Hour] *[Max. Marks : 30*

Instructions to the candidates:

1) ***Solve Q.1 or Q.2, Q.3 or Q.4.***
2) ***Figures to the right indicates full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable additional data, if necessary***
5) ***Use of a non-programmable calculator is allowed.***

Q1) a) What is a swing curve? Comment on the significance of the swing curve in the stability study along with its graphical representation. **[3]**

b) Derive the Swing equation of the synchronous machine. **[5]**

c) A generator is connected to an infinite bus through the transmission line, in which R is ignored. The voltage behind the transient reactance is 1.125 pu. Initial mechanical input and electrical power output is 0.95 pu. The infinite bus voltage is 1pu. The transfer reactance between the generator and bus bar under various conditions are:

Pre-fault: 0.65 pu, During fault: 1.5 pu, Post fault: 1.0 pu

Determine the critical clearing angle (δ_{cr}) by using Equal Area Criteria. Hence, draw the power angle curve for this situation. **[7]**

OR

Q2) a) What is the significance of Critical clearing angle (δ_{cr}) and Critical clearing time (t_{cr}) in the power system stability studies? **[3]**

b) Describe the concept of equal area criteria applied to power system stability. Derive it along with the stability criterion. **[5]**

c) A synchronous machine is connected to an infinite bus through a tie link. The internal voltage of the machine is 1.8 pu, infinite bus voltage is 1 pu and transfer reactance is 1.2 pu. Initial mechanical input and electrical power output is 0.9 pu. Determine and comment on the stability using equal area criteria when mechanical input is suddenly changed to 1.1 pu. Draw the power angle curve for this situation. **[7]**

P.T.O.

Q3) a) State whether the following statements are true or false appropriate justification: **[3]**

i) The UPFC consists of two voltage source converters; series and shunt. The series converter acts as SSSC and the shunt converter acts as FC-TCR.

ii) The STATCOM is a series connected device that injects appropriate voltage phasor in series with the line.

b) Classify the following FACTS devices under series connected device, shunt connected device and series shunt connected device. **[5]**

i) STATCOM

ii) TCSC

iii) FC-TCR

iv) SSSC

v) UPFC

c) What is the loading capability curve of a synchronous generator? Sketch the loading capability curve of a synchronous generator showing necessary labels. Hence explain field current limit. **[7]**

OR

Q4) a) Compare series capacitors and shunt capacitors in the context of reactive power control. **[3]**

b) Explain in detail reactive power requirements for power factor control along with its phasor diagrams. **[5]**

c) Explain the working principle, circuit diagram and V-I characteristics of STATCOM. Mention any two applications of it. **[7]**