*Total No. of Questions: 6* *Total No. of Printed Pages:3*

**Enrollment No.....**

# Faculty of Engineering

## End Sem (Odd) Examination Dec-2019

## EE3CO12 / EX3CO12 Power System-II

Programme: B.Tech. Branch/Specialisation: EE/EX

**Duration: 3 Hrs.** **Maximum Marks: 60**

Note: All questions are compulsory. Internal choices, if any, are indicated. Answers of Q.1 (MCQs) should be written in full instead of only a, b, c or d.

Q.1 i. Which of the following power system problem is not static? **1**

(a) Load flow (b) Transient stability

(c) Economic dispatch (d) All of these

ii. Normally *Y* bus matrix is a **1**

(a) Null matrix (b) Sparse matrix

(c) Singular matrix (d) Zero matrix

iii. For n bus power system size of Y bus matrix is **1**

(a) (n-1) ×(n-1) (b) n×n

(c) (n-1)×(n-2) (d) (n-2)×(n-2)

iv. The value of off diagonal elements of $Y-Bus$ is admittance **1**

(a) Which is connected between bus i and bus j with negative sign

(b) Which is connected between bus i and bus j with positive sign

(c) Sum of admittances connected at bus i

(d) Sum of admittances connected at bus j

v. Steady-state stability of a power system is improved by **1**

(a) Reducing fault clearing time

(b) Using double circuit line instead of single circuit line

(c) Single pole switching

(d) Decreasing generator inertia

vi. The critical clearing time of a fault is power system is related to **1**

(a) Reactive power limit

(b) Short circuit limit

(c) Steady-state stability limit

(d) Transient stability limit

P.T.O.

vii. With increase in fault clearing time, the transient stability limit of a power system **1**
(a) Increases
(b) Decreases
(c) First increases then decreases
(d) First decreases and then increases

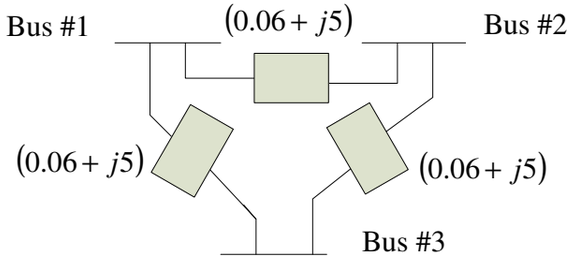
viii. Transient disturbances are caused by **1**
(a) Sudden load changes (b) Switching operations
(c) Fault in the power system (d) All of these

ix. If a line is considered with negligible power losses, then the real power transmitted will be proportional to sin(δ). **1**
(a) True (b) False

x. With increase in load, system frequency increases **1**
(a) True (b) False

Q.2 i. Discuss the applications of Y-bus and Z-bus matrix? **2**

ii. Connect a new bus (bus no.4) with bus no.2 through a new transmission line of impedance (0.04+j0.3) p.u. and form [$Y_{BUS}$] for the new system **3**




iii. Obtain 'π' model of an OLTC which is connected to one end of a transmission line. The transmission line has series reactance of j0.15 p.u. and line charging susceptance is j0.05 p.u. Take a=1.05. **5**

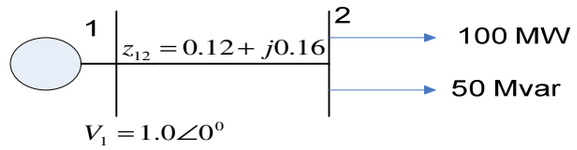
OR iv. Develop mathematical model of regulating transformer placed in a two bus system. **5**

Q.3 i. What is the need of Slack bus in load flow studies? **2**

ii. For the two bus system as shown in fig. below, bus 1 is a slack bus with $V_1 = 1.0\angle 0^0\ p.u.$ A load of 100 MW and 50 Mvar is taken from **8**



bus 2. Using N-R Method, obtain the voltage magnitude and phase angle of bus 2. Start with an initial estimate of $|V_2|^{(0)} = 1.0\ p.u.$ and $\delta_2^{(0)} = 0^0$. Perform two iterations.




OR iii. Briefly discuss the Gauss-Siedal method of solving power flow equations. How do you include voltage control buses? **8**

Q.4 i. Explain the necessity of maintaining a constant frequency in power system operation. **3**

ii. Explain briefly the different parts of speed governing system. **7**

OR iii. A subgrid has total rated capacity 3000 MW. It encounters a loads increase of 40 MW when the normal operating load is 2000 MW. Assume $H = 5$ Sec and regulation of generators in the system as 3 Hz/p.u MW. Find: **7**
(a) ALFC loop parameters
(b) Static frequency drop
(c) Transient response of ALFC loop

Q.5 i. Explain the role of reactive power in voltage control. **4**

ii. Explain a static VAR system. **6**

OR iii. Explain general block diagram for voltage regulators. **6**

Q.6 Attempt any two:

i. Classify the power system stability. **5**

ii. Derive power angle equation of a two machine system. **5**

iii. Starting from first principle, derive the swing equation of a synchronous machine. **5**

******

# Marking Scheme
## EE3CO12 / EX3CO12 Power System-II

| | | | | |
|---|---|---|---|---|
| Q.1 | i. | Which of the following power system problem is not static?<br>(b) Transient stability | | **1** |
| | ii. | Normally $Y$ bus matrix is a<br>(b) Sparse matrix | | **1** |
| | iii. | For n bus power system size of Y bus matrix is<br>(b) n×n | | **1** |
| | iv. | The value of off diagonal elements of Y$-Bus$ is admittance<br>(a) Which is connected between bus i and bus j with negative sign | | **1** |
| | v. | Steady-state stability of a power system is improved by<br>(b) Using double circuit line instead of single circuit line | | **1** |
| | vi. | The critical clearing time of a fault is power system is related to<br>(d) Transient stability limit | | **1** |
| | vii. | With increase in fault clearing time, the transient stability limit of a power system<br>(b) Decreases | | **1** |
| | viii. | Transient disturbances are caused by<br>(d) All of these | | **1** |
| | ix. | If a line is considered with negligible power losses, then the real power transmitted will be proportional to sin(δ).<br>(a) True | | **1** |
| | x. | With increase in load, system frequency increases<br>(b) False | | **1** |
| Q.2 | i. | Applications of Y-bus<br>Z-bus matrix | 1 mark<br>1 mark | **2** |
| | ii. | Diagram<br>Solution | 1 mark<br>2 marks | **3** |
| | iii. | Obtain ‘π’ model of an OLTC<br>Stepwise marking | | **5** |
| OR | iv. | Develop mathematical model of regulating transformer<br>Stepwise marking | | **5** |
| Q.3 | i. | Need of Slack bus in load flow studies | | **2** |
| | ii. | Using N-R Method,<br>Voltage magnitude and phase angle<br>Rest | <br>4 marks<br>4 marks | **8** |
| OR | iii. | Gauss-Siedal method of solving power flow equations<br>Include voltage control buses | 5 marks<br>3 marks | **8** |
| Q.4 | i. | Necessity of maintaining a constant frequency | | **3** |
| | ii. | Two parts of speed governing system<br>3.5 marks for each | <br>(3.5 marks*2) | **7** |
| OR | iii. | Find:<br>(a) ALFC loop parameters<br>(b) Static frequency drop<br>(c) Transient response of ALFC loop | <br>2 marks<br>2 marks<br>3 marks | **7** |
| Q.5 | i. | Role of reactive power in voltage control<br>Any two 2 marks for each | <br>(2 marks * 2) | **4** |
| | ii. | Static VAR system<br>Diagram<br>Explanation<br>Equation | <br>3 marks<br>2 marks<br>1 mark | **6** |
| OR | iii. | General block diagram for voltage regulators<br>Explanation | 3 marks<br>3 marks | **6** |
| Q.6 | | Attempt any two: | | |
| | i. | Definition of stability<br>Classification the power system stability | 3 marks<br>2 marks | **5** |
| | ii. | Derive power angle equation of a two machine system.<br>Stepwise marking | | **5** |
| | iii. | Starting from first principle, derive the swing equation of a synchronous machine.<br>Stepwise marking | | **5** |

******