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

Enrollment No.....

Faculty of Engineering

End Sem (Even) Examination May-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. OLTC in transmission line is used for- **1**

(a) Real power control (b) Reactive power control
(c) Power angle control (d) None of these

ii. Y bus is a - **1**

(a) Sparse matrix (b) Dense matrix
(c) Unity matrix (d) None of these

iii. Power flow equations are - **1**

(a) Linear algebraic (b) Non-Linear algebraic
(c) Linear Differential (d) Non-Linear Differential

iv. If the penalty factor of a plant is unity, its incremental transmission loss is - **1**

(a) 1.0 (b) -1.0 (c) Zero (d) None of these

v. Time constant of a power system, when compared to a speed governor is **1**

(a) Less (b) More (c) Same (d) None of these

vi. The frequency of the power system controls the - **1**

(a) Active power (b) Reactive power
(c) Both (a) and (b) (d) None of these

vii. General methods of voltage control are - **1**

(a) Use of tap-changing transformer
(b) Synchronous condensers
(c) Static capacitors
(d) All of these

P.T.O.

viii. The voltage at the bus can be controlled by the injection of _____ power of the correct sign. **1**
(a) Real (b) Reactive (c) Complex (d) Both (a) and (b)

ix. For a turbo alternator of 100 MVA, the inertia constant is 5. The value of inertia constant for 50 MVA alternator will be – **1**
(a) 8 (b) 12 (c) 10 (d) 15

x. For stable operation, the normal value of power angle (δ) normally lies between - **1**
(a) 0 to 30^0 (b) 0 to 90^0 (c) 0 to 60^0 (d) 0 to 180^0

Q.2 i. Define and classify Regulating Transformers. **3**

ii. Explain the formation of Y bus matrix in power systems using the Singular Transformation method. **7**

OR iii. Develop a general model for a tap changing transformer in terms of Y parameters, assuming line admittance is 'y' and transformation ratio is 1 : a. **7**

Q.3 i. Specify types of buses used in load flow studies. **3**

ii. Define Newton Raphson method for load flow study. Also write advantages and disadvantages (two each). **7**

OR iii. The incremental cost in Rs./MWhr for two plants are **7**
$IC_1 = 0.20\ P_1 + 40$; $IC_2 = 0.25\ P_2 + 30$
Calculate the extra cost incurred in Rs/hr for equal generation i.e. $P_1 = P_2 = 110$ MW, as compared to economic dispatch. The total load is 220 MW.

Q.4 i. Define the load frequency control. Also explain the concept of control area in it. **3**

ii. Obtain the steady state analysis for single area load frequency control for 1pu change in load conditions (ΔP_D). Also draw the block diagram. **7**

OR iii. Two generators rated 500MW and 250MW are operating in parallel. The droop characteristics are 4 percent and 6 percent respectively. **7**

Assuming that the generators are operating at 50 Hz at no load, how would a load of 750MW is shared? What is the system frequency? Assume free governor action.

Q.5 i. Define the static VAR systems. **3**

ii. Explain any one method of voltage control with diagram at load bus. **7**

OR iii. Explain static excitation system for alternator with block diagram. **7**

Q.6 Attempt any two:

i. Derive and explain Swing equation. **5**

ii. Derive equal Area Criteria for transient stability analysis. **5**

iii. A 60 Hz, 4 pole turbo generator rated 100MVA, 13.8 KV has inertia constant of 10 MJ/MVA. **5**
(a) Find stored energy in the rotor at synchronous speed.
(b) If the input to the generator is suddenly raised to 60 MW for an electrical load of 50 MW, find rotor acceleration.

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Marking Scheme
EE3CO12 / EX3CO12 Power System-II

Q.1 i. OLTC in transmission line is used for- **1**
(b) Reactive power control

ii. Y bus is a - **1**
(a) Sparse matrix

iii. Power flow equations are - **1**
(b) Non-Linear algebraic

iv. If the penalty factor of a plant is unity, its incremental transmission loss is - **1**
(c) Zero

v. Time constant of a power system, when compared to a speed governor is **1**
(b) More

vi. The frequency of the power system controls the - **1**
(a) Active power

vii. General methods of voltage control are - **1**
(d) All of these

viii. The voltage at the bus can be controlled by the injection of _____ power of the correct sign. **1**
(b) Reactive

ix. For a turbo alternator of 100 MVA, the inertia constant is 5. The value of inertia constant for 50 MVA alternator will be – **1**
(c) 10

x. For stable operation, the normal value of power angle (δ) normally lies between - **1**
(a) 0 to 30^0

Q.2 i. Regulating Transformers. **3**
Definition 1.5 marks
Classification 1.5 marks

ii. Formation of Y bus matrix in power systems using the Singular Transformation method. **7**
Diagram 2 marks
Explanation 2 marks
Derivation 3 marks

OR iii. Develop a general model for a tap changing transformer **7**
Diagram 2 marks
Explanation 2 marks
Derivation 3 marks

Q.3 i. Types of buses used in load flow studies. **3**
1 mark for each (1 mark * 3)

ii. Newton Raphson method for load flow study **7**
Explanation 2 marks
Equations 3 marks
Two Advantages 0.5 mark for each (0.5 mark * 2) 1 mark
Two disadvantages 0.5 mark for each (0.5 mark * 2) 1 mark

OR iii. Calculate the extra cost incurred in Rs/hr for equal generation **7**
Economic solution 4 marks
Calculate the extra cost 3 marks

Q.4 i. Load frequency control 1.5 marks **3**
Concept of control area 1.5 marks

ii. Explanation 2 marks **7**
Equations 3 marks
Block diagram. 2 marks

OR iii. How would a load of 750MW is shared? What is the system frequency? Assume free governor action. **7**
Equations 5 marks
Solution 2 marks

Q.5 i. Define the static VAR systems. **3**
Explanation 2 marks
Diagram 1 mark

ii. Any one method of voltage control with diagram at load bus. **7**
Explanation 4 marks
Diagram 3 marks

OR iii. Static excitation system for alternator with block diagram. **7**
Explanation 4 marks
Diagram 3 marks

Q.6 Attempt any two:

i. Swing equation. **5**

Derivation 3 marks

Explanation 2 marks

ii. Equal Area Criteria for transient stability analysis. **5**

Derivation 4 marks

Diagram 1 mark

iii. (a) Stored energy in the rotor at synchronous speed. **5**

2 marks

(b) If the input to the generator is suddenly raised to 60 MW for an electrical load of 50 MW, find rotor acceleration.

3 marks

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