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Invigilator's Signature :	

CS/B.Tech (EE-NEW)/SEM-8/EE-801B/2010 2010

POWER SYSTEM DYNAMICS & CONTROL

Time Allotted: 3 Hours Full Marks: 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any ten of the following:

 $10 \times 1 = 10$

- i) At natural loading of the power system transmission line the receiving end power factor is
 - a) leading
- b) lagging

c) unity

- d) either (b) or (c).
- ii) Synchronous motor can operate at
 - a) lagging power factor only
 - b) leading power factor only
 - c) unity power factor only
 - d) lagging, leading and unity power factor.
- iii) Which of the following compensators directly improves system load ability?
 - a) SVC
 - b) Shunt capacitor
 - c) Series capacitor
 - d) Synchronous condenser.

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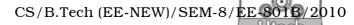


- iv) Voltage stability limit is obtained when
 - a) the Jacobian of load flow equation is singular
 - b) the Jacobian of load flow equation is non-singular
 - c) the Jacobian of load flow equation is monotonic
 - d) the Jacobian of load flow equation does not signify anything.
- v) The deficit in reactive power can be encountered by
 - a) local reactive power support
 - b) generator terminal voltage increase
 - c) series capacitor installation
 - d) any of these methods.
- vi) The intertia constant H of a machine of 200 MVA is 2.0 p.u. Its value corresponding to 400 MVA will be
 - a) 4·0

b) 2·0

c) 1.0

- d) 0.5
- vii) The intertia constant of two groups of machines which swing together are \mathbf{M}_1 and \mathbf{M}_2 . The intertia constant of the system is
 - a) $\frac{M_1 M_2}{M_1 + M_2}$
- b) $|\mathbf{M}_1 + \mathbf{M}_2|$
- c) $M_1 + M_2$
- d) $\frac{M_1 + M_2}{M_1 M_2}$.
- viii) Which of the following is constant impedance load?
 - a) Fluorescent lamp
- b) Incandescent lamp
- c) Induction motor
- d) Synchronous motor.
- ix) Type of surge impedance loading is
 - a) resistive
- b) inductive
- c) capacitive
- d) none of these.



- x) Shunt capacitor is used to
 - a) improve voltage
- b) improve P.F
- c) both of these
- d) none of these.
- xi) Magnitude of power angle at voltage stability limit depends on
 - a) power factor angle
- b) receiving end voltage
- c) sending end voltage
- d) none of these.

GROUP - B

(Short Answer Type Questions)

Answer any three of the following.

 $3 \times 5 = 15$

- 2. Define FACTS controllers. Mention the advantages of FACTS devices.
- 3. Why do small oscillations appear in power system network? What are the governing factors in generating small oscillations?
- 4. What is SVC? How would you model it?
- 5. What are the components of load compensation? What are the principles of power factor correction?
- 6. Which factors causing power system disturbances may lead to voltage collapse? Find the capacity of static VAR compensator to be installed at bus with ± 5% voltage fluctuation. The short circuit capacity is 5000 MVA.

GROUP - C

(Long Answer Type Questions)

Answer any three of the following.

 $3 \times 15 = 45$

- 7. a) Describe the Heffron-Phillips model of single machine infinite bus problem in a power network of an SMIB system.
 - b) What are the implications of k_1 k_6 parameters in Heffron-Phillips model?

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- 8. What do you mean by power system modelling? What is the necessity of modelling of the power system components? Analytically model a three phase single circuit transmission line. Explain how the Y_{BUS} matrix of a two-bus system will be changed if a voltage regulating transformer is introduced in the system. 2 + 3 + 4 + 6
- 9. Derive an expression of receiving end bus voltage and power angle at voltage stability limit.
- 10. a) What do you mean by steady state dynamic voltage stability?
 - b) How do you define voltage stability limit? Derive an expression for critical receiving end voltage for a two-bus system. 2+5
 - c) Derive an expression of critical load bus voltage and critical power angle at voltage stability limit. 5
- 11. a) What are the compensating devices used for the improvement of voltage stability? How do they work?

3 + 5

- b) Describe the performance characteristics of static VAR controllers with reference to range of control and speed of response.
- 12. What is voltage regulation in a transmission system? What is the importance of knowing voltage regulation? Find out the relation between voltage regulation and reactive power in a transmission system and comment from the relation how voltage depends on reactive power in a power system. Find out the expression for reactive power requirement for an uncompensated transmission line. 1 + 2 + 6 + 6

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