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**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SIXTH SEMESTER B.TECH DEGREE EXAMINATION(S), DECEMBER 2019

**Course Code: EE306**

**Course Name: POWER SYSTEM ANALYSIS**

Max. Marks: 100

Duration: 3 Hours

**PART A**

*Answer all questions, each carries 5 marks.*

- |   |  | Marks |
|---|--|-------|
| 1 | Prove that symmetrical components transformation is power invariant.   | (5)   |
| 2 | Explain different types of current limiting reactors   | (5)   |
| 3 | Starting from the first principles, obtain the equations of real power and reactive power used in load flow problem. | (5)   |
| 4 | Derive the block diagram representation of a generator-load model.   | (5)   |
| 5 | How loads are distributed between units within a plant?  | (5)   |
| 6 | What is the significance of thermal unit constraint in unit commitment problem?                                      | (5)   |
| 7 | Derive the swing equation of a synchronous machine?  | (5)   |
| 8 | Draw and explain power angle curve of a synchronous machine?   | (5)   |

**PART B**

*Answer any two full questions, each carries 10 marks.*

- |    |  |      |
|----|--|------|
| 9  | a) How will you draw a reactance diagram when the single line diagram of a power system is given?  | (6)  |
|    | b) A three phase delta-star transformer with a rating of 1000 kVA, 11kV/400V has its primary and secondary leakage reactance as $12\Omega/\text{ph}$ and $0.05\Omega/\text{ph}$ respectively. Calculate the p.u reactance of transformer | (4)  |
| 10 | a) The symmetrical components of phase a voltages in a 3-phase unbalanced system are $V_{a0}=10\angle 180^\circ$ V, $V_{a1}=50\angle 0^\circ$ V and $V_{a2}=20\angle 90^\circ$ V. Determine the phase voltages $V_a$ , $V_b$ and $V_c$   | (6)  |
|    | b) What are the effects of faults in power system? Explain symmetrical fault and why its calculation is necessary?   | (4)  |
| 11 | Derive the expression for fault current and draw the interconnection of sequence networks for double line to ground fault on the terminals of an unloaded generator.   | (10) |

*Answer any two full questions, each carries 10 marks.*

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|----|---|------|
| 12 | Explain the algorithm for load flow analysis using Newton-Raphson Method. | (10) |
| 13 | a) Give reasons for :   | (5)  |

- i) Direct solution of load flow problem is not possible.  
 ii) Bus admittance matrix is sparse matrix.
- b) A 100MVA synchronous generator operates on full load at frequency of 50 Hz. The load is suddenly reduced by 50 MW. Due to time lag in governor system, the steam valve begins to close after 0.4 s. Determine the change in frequency that occurs in this time. Given  $H = 5 \text{ kW-s/kVA}$ . (5)
- 14 Draw the block diagram representation of Load Frequency Control (LFC) of a single area system & explain the steady state stability for free governor operation ( $\Delta P_c = 0$ ) (10)

### PART D

*Answer any two full questions, each carries 10 marks.*

- 15 A two bus system is shown in figure below. If a load of 125MW is transmitted from plant 1 to the load, a loss of 15.625MW is incurred. Determine the generation schedule and the load demand if the cost of received power is Rs.24/MWhr. Solve the problem using coordination equations and the penalty factor method. The incremental production costs of the plants are: (10)

$$dF_1/dP_1 = 0.025P_1 + 15$$

$$dF_2/dP_2 = 0.05P_2 + 20$$



- 16 a) Distinguish between economic dispatch and unit commitment. (5)  
 b) Explain the method of solving swing equation by point-by-point method. (5)
- 17 Using equal area criterion, derive an expression for critical clearing angle for a system (10) having a generator feeding an infinite bus through a single circuit line.

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