

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Sixth semester B.Tech degree examinations (S), September 2020

Course Code: EE306

Course Name: POWER SYSTEM ANALYSIS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks.

Marks

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| 1 | Define per unit representation of electrical quantities? List out its advantages. | (5) |
| 2 | Explain short circuit MVA and its significance in analysing faults in power system. | (5) |
| 3 | Classify the various types of buses in a power system for load flow studies. | (5) |
| 4 | Explain the basic generator control loops. | (5) |
| 5 | Two units have following cost function
$F_1 = 120 + 22P_1 + 0.05P_1^2$ Rs/hr
$F_2 = 120 + 16P_2 + 0.06P_2^2$ Rs/hr
where P_1 and P_2 in MW. The generator limits are
$20 \leq P_1 \leq 100$ MW
$20 \leq P_2 \leq 100$ MW
Find the economic dispatch for a total demand of 180 MW. | (5) |
| 6 | Explain unit commitment? List out the constraints on unit commitment. | (5) |
| 7 | Explain the three different stabilities of a power system. | (5) |
| 8 | Explain critical clearing angle and its significance with respect to the stability of a power system. | (5) |

PART B

Answer any two full questions, each carries 10 marks.

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| 9 | A 30 MVA, 13.8 KV, 3-phase generator has a sub transient reactance of 15%.
The generator supplies 2 motors through a step-up transformer - transmission line – step-down transformer arrangement. The motors have rated inputs of 20 MVA and 10 MVA at 12.8 KV with 20% sub transient reactance each. The 3-phase transformers are rated at 35 MVA, 13.2 KV - Δ /115 KV-Y with 10 % leakage reactance. The line reactance is 80 ohms. Draw the equivalent per unit reactance diagram by selecting the generator ratings as base values in the generator circuit. | (10) |
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- 10 a) Explain the significance of symmetrical components in power system. (4)
 b) Derive the expression for symmetrical components of voltages in terms of phase voltages and hence obtain transformation matrix. (6)
- 11 Derive the expression for fault current and draw the interconnection of sequence networks for line to line fault on the terminals of an unloaded generator. (10)

PART C

Answer any two full questions, each carries 10 marks.

- 12 Derive the static load flow equations for a power system. (10)
- 13 a) Write down the steps involved in solving load flow equation using Guass Siedel method when voltage controlled buses are absent. (7)
 b) Enumerate the objectives of AGC. (3)
- 14 Develop and explain the block diagram of automatic load frequency control of an isolated power system. (10)

PART D

Answer any two full questions, each carries 10 marks.

- 15 a) Derive the expression for economic operation of a plant having different units neglecting transmission losses. (5)
 b) A 2 bus system consist of two power plants connected by a transmission line. (5)
 The cost curve characteristics of the two plants are
 $C_1 = 0.01P_1^2 + 18P_1 + 20$ Rs/hr
 $C_2 = 0.03P_2^2 + 33P_2 + 40$ Rs/hr
 When a power of 120 MW is transmitted from plant 1 to load (near to plant 2), a loss of 16.425 MW is occurred. Determine the optimal scheduling of plants and load demand, if cost of received power is 36 Rs./MWhr.
- 16 a) Explain the steady state limit of a power system with the help of power angle diagram. (3)
 b) Explain the equal area criterion for assessing the stability of a power system. (4)
 c) List the methods for improving transient stability of a power system. (3)
- 17 a) Derive the equation for penalty factor for optimal system operation. (5)
 b) Derive the swing equation representing the rotor dynamics of a synchronous machine. (5)
