Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (R,S) / (WP), S4 (PT) Exam April 2025 (2019 Scheme)

Course Code: EET304

Course Name: POWER SYSTEMS II

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1 Prove that symmetrical component transformation is power invariant. (3)

2 Explain short circuit MVA and its significance in analysing faults in power system (3)

3 Find the Y_{bus} Matrix for the data given below. (3)

From	To	Resistance	Reactance
1	2	0	0.34
2	3	0	0.42
1	3	0	0.30
2	0	0	0.15
3	0	0	0.1

4 State the Load Flow problem with the help of necessary equations for active and reactive power. (3)

5 Explain Steady state stability limit with the help of power angle curve. (3)

6 What are the different types of stabilities in power system. Give an example for each type of disturbances. (3)

7 What is Sub-synchronous resonance? What causes SSR? What is its effect on power system? (3)

8 Explain tie line power flow and synchronizing power coefficient. Explain its significance. (3)

9 Explain the terms-Heat Rate, Incremental Fuel cost, Penalty factor (3)

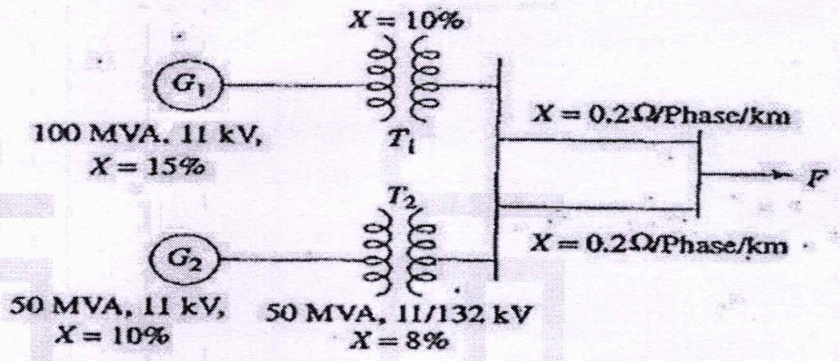
10 Write the co-ordination equation for deriving the condition for sharing load between generators within a plant. What are the constraints taken for the derivation? (3)

PART B

Answer one full question from each module, each carries 14 marks.

Module I

11 a) Following figure shows a generating station, feeding a 132 kV system. Determine the total fault current, Fault level and Fault current supplied by each alternator for a 3-phase fault at receiving end bus. Line is 200 Km long. (8)



b) What is per unit system? What are its advantages? Write the expression for converting the per unit impedance expressed on one base to another. (6)

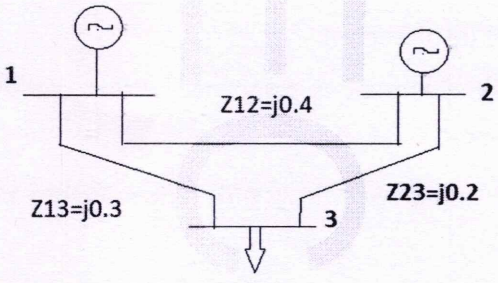
OR

12 a) The line currents in a 3-phase system are $I_a=5\angle 60°$ *A* , $I_b=5\angle -60°$ *A*, $I_c=0$. Find the symmetrical components. Resolve the unbalanced phasors into symmetrical components in phasor representation. (6)

b) Derive the expression for fault current in a double line to ground fault on an unloaded generator. Draw an equivalent network showing the inter connection of networks to simulate double line to ground fault. (8)

Module II

13 a) (8)



Bus 1	Slack Bus	V=1.05<0°	
Bus 2	PV Bus	V=1.0 pu	P_G=3 pu
Bus 3	PQ Bus	P_L =4 pu	Q_L=2 pu

Carry out one iteration of load flow method by G-S method.

b) What are the advantages and disadvantages of Newton Raphson method for Load flow studies. (6)

OR

14 a) Explain the computational procedure for load flow solution using fast decoupled load flow method. (10)

b) Slack bus is a generator bus. Comment on the statement. (4)

Module III

15 a) Starting from first principles of rotor dynamics, derive swing equation of a synchronous machine. (10)

b) Explain the effect of critical clearing time on stability. (4)

OR

16 a) Explain Equal Area criterion with necessary diagrams and state the assumptions. (8)

b) A 50 Hz, four pole turbogenerator rated 100 MVA, 11 kV has an inertia constant of 8.0 MJ/MVA. (6)

(a) Find the stored energy in the rotor at synchronous speed.

(b) If the mechanical input is suddenly raised to 80 MW for an electrical load of 50 MW, find rotor acceleration, neglecting mechanical and electrical losses.

(c) If the acceleration calculated above is maintained for 10 cycles, find the change in torque angle and rotor speed in revolutions per minute at the end of this period.

Module IV

17 a) Explain Automatic Generation control of two area. What occurs when a sudden load change occurs to one of the area. (10)

b) A 100 MVA synchronous generator operates on full load at a frequency of 50 Hz. Inertia constant is 8 MJ/MVA. The load is suddenly reduced to 100 MW. Due to time lag in governor system, the steam valve begins to close after 0.4 seconds. Determine the change in frequency that occurs during this time. (4)

OR

18 a) Derive the block diagram of Automatic Voltage Regulator. Explain the function of each component. (8)

b) Two generating units rated 300 MW and 400 MW have governor speed regulation of 6% and 4% respectively from no-load to full load. Both the generating units are operating in parallel to share a load of 600 MW. Assuming free governor action, find the load shared by the larger unit. (6)

Module V

19 a) Derive the condition for economic load scheduling between different plants. (8)
Explain how the transmission loss of a two-plant system depends on the generated powers of the power plant

b) The incremental cost characteristics of a two-plant system are as follows (6)

$$IC_1 = 1.0\ P_1 + 85\ Rs/MWhr$$

$$IC_2 = 1.2\ P_2 + 72\ Rs/MWhr$$

Where P_1 and P_2 are in MW. The loss coefficient matrix in MW^{-1} is given by

$$\begin{bmatrix} 0.015 & -0.001 \\ -0.001 & 0.02 \end{bmatrix}$$

Compute the optimum scheduling with λ=150 Rs/MWhr. Also find the power received by the load, transmission loss and also efficiency.

OR

20 a) What is the difference between Economic load dispatch and Unit commitment? (10)
What are the constraints for unit commitment problem involving thermal plants?

b) The fuel cost functions of two power plants are (5)

Plant P1: $C1 = 0.05P_1^{\ 2} + AP_1 + B$

Plant P2: $C2 = 0.01P_2^{\ 2} + 3AP_2 + 2B$

where P_1 and P_2 are the generator powers of two plants and A and B are constants. If the two plants optimally share 1000 MW load at incremental fuel cost of 100 Rs/MWh, find the ratio of load shared by the two plants.

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