

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S6 (S,FE) (FT/WP/S4 PT) Examination December 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 | Explain symmetrical components of the three phase system. | (3) |
| 2 | A three phase generator with rating 1000kVA, 33kV has its armature resistance and synchronous reactance as $30\Omega/\text{phase}$ and $85\Omega/\text{phase}$. Calculate p.u impedance of the generator. | (3) |
| 3 | Classify various types of buses in power system for load flow studies. | (3) |
| 4 | Write four ways of adding an impedance to an existing system so as to modify bus impedance matrix. | (3) |
| 5 | What are the methods of improving transient stability of the power system? | (3) |
| 6 | Draw and explain power angle curve of a synchronous machine. | (3) |
| 7 | A 100MVA, 50Hz alternator is operating at rated speed. The H constant of the machine is 4kW-sec per kVA. The load suddenly increases by 40MW. Due to delay in governor action there is a delay of 0.5 second in opening of steam valve. Find the frequency deviation. | (3) |
| 8 | With schematic diagram explain automatic voltage regulator. | (3) |
| 9 | Discuss about constraint in Unit Commitment problem. | (3) |
| 10 | Define penalty factor. Explain incremental cost in terms of penalty factor. | (3) |

PART B*Answer one full question from each module, each carries 14 marks.***Module I**

- | | | |
|----|--|------|
| 11 | a) Show that positive and negative sequence currents are equal in magnitude but out of phase 180° in a line to line fault on unloaded generator. Derive the fault current and draw diagram showing interconnection of sequence networks for this type of fault. | (10) |
| | b) Define per unit value. What are the advantages of per unit system? | (4) |

OR

- 12 a) A synchronous generator and motor are rated for 30000kVA, 13.2kV and both have sub transient reactance of 20%. The line connecting them has a reactance of 10% on the base of machine ratings. The motor is drawing 20000kW at 0.8pf leading. The terminal voltage of the motor is 12.8kV. When a symmetrical three phase fault occurs at motor terminals, find the sub transient current in generator, motor and at the fault point. (10)
- b) Write the condition for single line to ground and Double line to ground fault on an unloaded generator and draw the sequence network. (4)

Module II

- 13 a) The following is the system data for load flow solution. The line admittances are given in the following table. (10)

Bus code	Admittance
1-2	$0.05+j0.15$ p.u
1-3	$0.10+j0.30$ p.u
1-4	$0.20+j0.40$ p.u
2-4	$0.10+j0.30$ p.u
3-4	$0.05+j0.15$ p.u

The schedule of active and reactive powers are:

Bus Code	P	Q	V	Remarks
1	-	-	$1.05\angle 0^\circ$	Slack bus
2	0.5	- 0.2	-	PQ bus
3	-1.0	0.5	-	PQ bus
4	0.3	-0.1	-	PQ bus

Determine the voltages at the end of first iteration by Gauss Seidel method.

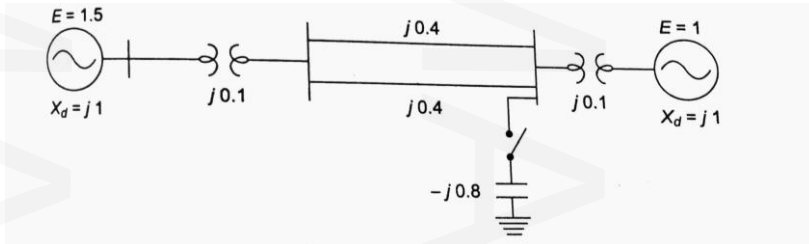
- b) Derive equation for elements of Jacobian using rectangular coordinates. (4)

OR

- 14 a) Explain Fast Decoupled method of load flow solution with flow chart. (10)
- b) Compare Gauss Seidel and Newton-Raphson methods of load flow analysis. (4)

Module III

- 15 a) Find the maximum steady state power transfer a) when capacitor is connected b) when capacitor is replaced by an inductor of the same value. All the reactance are to a common base. (9)



- b) Derive the swing equation of a synchronous machine. (5)

OR

- 16 a) Two power station A and B are located close together, Station A has 5 identical generator sets each rated 100MVA and having an inertia constant of 8MJ/MVA whereas the station B has 4 sets each rated 200MVA, 4MJ/MVA. Calculate the inertia constant of a single equivalent machine on a base of 100MVA. (8)
- b) Explain the point by point method for solving the swing equation. (6)

Module IV

- 17 Develop and explain the block diagram of load frequency control of a single area system. (14)

OR

- 18 a) A control area has a total rated capacity of 10000MW. The regulation R for all the units in the area is 2 Hz/pu MW. A one per cent change in frequency causes a one per cent change in load. If the system is operating at half of rated capacity and the load increases by 2% (i) find the static frequency drop (ii) If the speed governor loop were open, what would be the frequency drop. (7)
- b) Explain the basic generator control loops. (7)

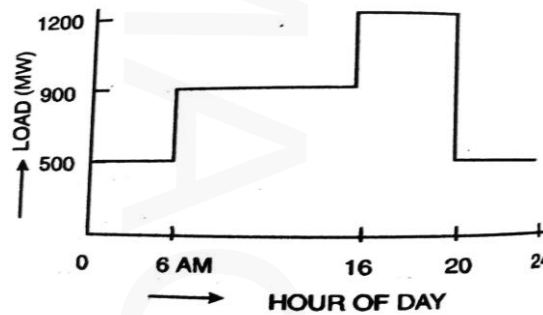
Module V

- 19 a) The fuel cost characteristic of two thermal plants are as under: (10)

$$C_1 = 5200 + 52.8P_1 + 0.0055P_1^2 \text{ Rs/hour}$$

$$C_2 = 3400 + 15P_2 + 0.05P_2^2 \text{ Rs/hour}$$

The limits of generation for the two units $200 \leq P \leq 800 \text{ MW}$. The load curve is shown in Fig. Find the daily operating schedule to minimize the operating cost.

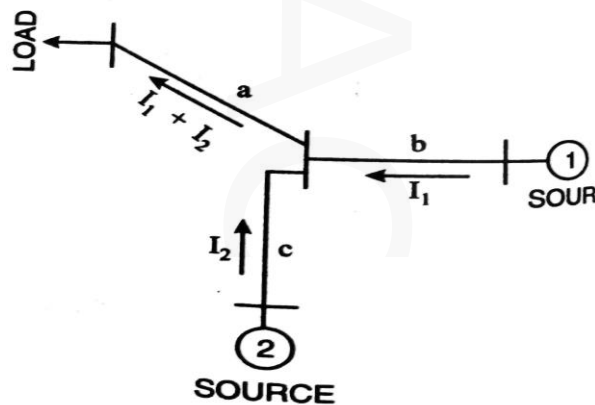


The cost of taking a unit off and then putting it on is Rs.1500/-.

- b) Define input-output characteristic, heat rate and incremental cost. (4)

OR

- 20 a) Find the loss coefficients and the transmission loss as shown in fig, $I_1 = 0.8 \angle 0^\circ$ p.u. and $I_2 = 1.0 \angle 0^\circ$ p.u. Line impedance are $0.04 + j0.12$ p.u., $0.03 + j0.1$ p.u and $0.03 + j0.12$ p.u. for the section a, b and c respectively. The voltage at load bus is $1 \angle 0^\circ$ p.u. (9)



- b) Derive an expression for the transmission loss and express it as a function of plant loading. (5)
