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M.E./M.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2022.

First Semester

Power Systems Engineering

PS 4101 — COMPUTER AIDED POWER SYSTEM ANALYSIS

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What is the need for adopting Optimal Ordering Schemes to represent a power system.

2. Highlight the advantages and disadvantages of using Triangular decomposition method and LU factorization method.

3. State any two types of constraints in a power system.

4. Differentiate Power Flow Analysis and Optimal Power Flow Analysis.

5. What is the main advantage of Optimal Power Flow studies.

6. Is the reactive power control essential for Optimal Power Flow? If so why?

7. Mention the impact of mutual coupled lines in forming Z_{BUS} and also for short circuit studies in a power system.

8. List out the various types of short circuits in a power system. Among them which is the most severe fault.

9. What is the main limitation in Equal Area Criterion.

10. Mention the advantages of using R-K method.

PART B — (5 × 13 = 65 marks)

11. (a) Define the concept of sparsity and how the storing of the sparse matrices be represented in different approaches

Or

(b) For the given IEEE 14 Bus, 20 Line Power System explain the various methods adopted for the optimal ordering schemes using Sparsity Technique.

Line Number	From Bus	To Bus
1	1	2
2	1	5
3	2	3
4	2	4
5	2	5
6	3	4
7	4	5
8	7	8
9	7	9
10	9	10
11	9	14
12	10	11
13	6	12
14	6	13
15	12	13
16	4	7
17	4	9
18	5	6
19	6	11
20	13	14

12. (a) The system data for a load flow problem are given in Table.

(i) Compute Y bus (6)

(ii) Determine the bus voltage at the end of first iteration by NR method. (7)

Bus Data:

Bus Code	P_{demand} in pu	Q_{demand} in pu	V in pu	Bus type
1	–	–	1.06	Slack
2	0.5	0.2	–	PQ
3	0.4	0.3	–	PQ

Line Data:

Line No.	Bus Code	Admittance in pu
1	1–2	2-j8
2	1–3	1-j4
3	2–3	0.6–j2.6

Or

(b) Discuss he following in detail

(i) Need for using Fast Decoupled Power Flow Method

(ii) Sensitivity Factors for the P-V parameters adjustment

13. (a) Explain how the Optimal Power Flow problem be expressed using objective function, constraints, augmented objective function and how the necessary and sufficient conditions be arrived.

Or

(b) Write short notes on the following

(i) Security Constrained Optimal Power Flow Problem. (6)

(ii) Detailed cost function associated with the Linear programming Method with AC power flow variables. (7)

14. (a) Derive an expression for the fault current, if a LG and LLG faults when occurs in a power system through fault impedance ZF.

Or

(b) (i) The current flowing in the lines towards a balanced load connected in a delta connected system are

$$I_a = 100\angle 0^\circ, I_b = 141.4\angle 225^\circ \text{ and } I_c = 100\angle 90^\circ$$

Find the symmetrical components of the given line currents and draw the phasor diagram of the positive and negative line and phase currents. (7)

(ii) Derive the expression of three phase power in terms of symmetrical components. (6)

15. (a) Derive the Power Angle Equation for non-salient pole and salient pole machine. Highlight by commenting which type of machine is preferable for a better transient stability enhancement.

Or

(b) (i) Highlight the various factors influencing transient stability in a power system. (6)

(ii) Discuss in detail about the Implicit integration Methods. (7)

PART C — (1 × 15 = 15 marks)

16. (a) Summarize elaborately and highlight the supremacy of step-by-step method, RK Method and Modified Euler's method.

Or

(b) Obtain the expression for the critical clearing angle when a short circuit occurs at the middle of one of the parallel lines of a Single Machine connected to an Infinite Bus (SMIB). Comment on the critical clearing angle if short circuit occurs at the receiving end.