GUJARAT TECHNOLOGICAL UNIVERSITY

BE-7 SEMESTER – OLD PAPER – S22 TO S25 – QUESTION BANK

Subject Name & Code:

Power Quality and FACTS- 3170921

Unit 1: Power Quality

Repeated Questions:

1. **Define/Explain Power Quality and its importance.**
   - Appeared in: S22 (Q1a, 03 marks), W24 (Q1a, 03 marks)
2. **Discuss/Explain the concept of Grounding. Elaborate on Single-point and Multipoint grounding.**
   - Appeared in: S22 (Q2a, 03 marks), S25 (Q1c, 07 marks), W24 (Q1c, 07 marks)
3. **What are transients? Discuss Impulse transients and Oscillatory transients.**
   - Appeared in: W23 (Q4a, 03 marks), W24 (Q1b, 04 marks), W23 (Q1a, Part)
4. **What is Flicker? List reasons responsible for flicker and its mitigation techniques.**
   - Appeared in: W22 (Q1b, 04 marks), S23 (Q5c, 07 marks), W24 (Q5a, 03 marks)
5. **Draw and explain the ITIC/CBEMA graph and explain its various regions.**
   - Appeared in: S23 (Q1c, 07 marks), W23 (Q1c, 07 marks), W22 (Q4c, OR, 07 marks), W24 (Q5b, OR, 04 marks)

Other Important Questions:

1. **Enlist common disturbances in power systems.**
   - Appeared in: S25 (Q1a, 03 marks)
2. **Explain solutions to power quality problems in brief.**
   - Appeared in: S25 (Q1b, 04 marks)
3. **Explain all Power Quality Issues with necessary diagrams.**
   - Appeared in: S22 (Q1c, 07 marks)
4. **With necessary waveforms, discuss in detail the following Power Quality Disturbances: i) Voltage Sag, ii) Voltage Swell, iii) Harmonics.**
   - Appeared in: S23 (Q1a, 07 marks)
5. **Discuss the need for reliability indices and explain the following terms: SAIFI, SAIDI, CAIFI.**
   - Appeared in: S23 (Q1b, 07 marks)
6. **Define: Displacement, Distortion & True power factor.**

- Appeared in: S23 (Q3a, 03 marks), W22 (Q1a, 03 marks)

7. **Explain various power quality issues due to distributed generation.**
   - Appeared in: W22 (Q1c, 07 marks)
8. **Explain the need for site surveys in PQ monitoring.**
   - Appeared in: S23 (Q5a, 07 marks)
9. **Discuss the role of data loggers and chart recorders in the measurement of power quality.**
   - Appeared in: S23 (Q5b, 07 marks)
10. **Describe the objectives and procedures for performing power quality monitoring.**
    - Appeared in: W22 (Q5c, OR, 07 marks), S25 (Q5c, 07 marks)
11. **List out various equipment used for Power Quality Measurements.**
    - Appeared in: S22 (Q5a, OR, 03 marks), W22 (Q5a, 03 marks)

Unit 2: Static Var Compensators and FACTS

Repeated Questions:

1. **What are the different types of FACTS controllers?**
   - Appeared in: W22 (Q2b, 04 marks), S25 (Q2a, 03 marks), W24 (Q3a, 03 marks)
2. **List out and explain various applications of SVCs.**
   - Appeared in: S23 (Q2a, 07 marks), W22 (Q3b, 04 marks), W23 (Q3a, 07 marks), W23 (Q3a, OR, 07 marks)
3. **Explain the role of SVC device for Reactive Power Compensation.**
   - Appeared in: S22 (Q2c, 07 marks), W24 (Q2c, 07 marks)
4. **Explain the schematic diagram and working principle of a STATCOM.**
   - Appeared in: W22 (Q4c, 07 marks), S22 (Q3c, OR, 07 marks), W24 (Q3c, 07 marks)
5. **What is load compensation?**
   - Appeared in: W23 (Q2a, 03 marks), S25 (Q2b, 04 marks), W24 (Q2a, 03 marks)
6. **Compare different Static Var Compensators (TCR, TSC, STATCOM, FC-TCR).**
   - Appeared in: S23 (Q2c, 07 marks), S23 (Q2c, OR, 07 marks), W22 (Q3c, 07 marks), S25 (Q2c, 07 marks), W24 (Q2c, OR, 07 marks)

Other Important Questions:

1. **Explain the importance of FACTS controllers for Power Quality.**
   - Appeared in: S22 (Q2b, 04 marks)
2. **With a necessary diagram, discuss about FC-TCR in detail. State its advantages and limitations.**
   - Appeared in: S23 (Q2c, OR, 07 marks), W23 (Q2c, 07 marks)
3. **Explain the working of SVC device using TSC-TCR with necessary diagrams.**
   - Appeared in: S22 (Q3c, 07 marks), W22 (Q5c, 07 marks)
4. **How Static Var Compensators (SVCs) are used to improve the transient stability of the power system?**
   - Appeared in: W23 (Q2b, 04 marks), W24 (Q4c, 07 marks)
5. **Discuss the increase in transient stability margin and its improvement using SVC.**
   - Appeared in: S23 (Q3b, OR, 07 marks)
6. **Draw and explain the block diagram for an SVC automatic voltage regulator.**
   - Appeared in: S23 (Q4b, 07 marks)
7. **Describe STATCOM.**
   - Appeared in: S25 (Q2c, OR, 07 marks)
8. **Compare different static Var systems and discuss the specification of SVCs.**
   - Appeared in: S25 (Q2c, 07 marks)
9. **Explain the applications of SVC and STATCOM devices.**
   - Appeared in: S22 (Q3b, OR, 04 marks), W24 (Q2b, 04 marks)

Unit 3: Control of Static Var Compensators

Repeated Questions:

1. **Discuss the control systems for SVCs in traction applications.**
   - Appeared in: S25 (Q3c, 07 marks), W23 (Q3c, 07 marks)
2. **Explain the need/role of SVC in a Traction System.**
   - Appeared in: S23 (Q3b, 07 marks), W23 (Q3a, 07 marks)
3. **Explain Reactive Power Control and Coordination by SVCs.**
   - Appeared in: S25 (Q3a, 03 marks), W23 (Q3c, OR, 07 marks)

Other Important Questions:

1. **Describe Power Oscillation Damping and Subsynchronous resonance damping enhancement.**
   - Appeared in: W24 (Q3b, 04 marks)
2. **Explain the concept of load compensation, voltage regulation, and balancing.**
   - Appeared in: S25 (Q2b, 04 marks)
3. **Discuss the Phase Locked Oscillator control system.**
   - Appeared in: S23 (Q4b, OR, 07 marks)
4. **Discuss saturated reactor (SR).**
   - Appeared in: S25 (Q3b, 04 marks)

Unit 4: Harmonics

Repeated Questions:

1. **Define/Explain the concept of Harmonics and its side effects/undesirable effects on the power system/components.**
    - Appeared in: S22 (Q3a, OR, 03 marks), W22 (Q3a, 03 marks), S25 (Q4c, 07 marks), W23 (Q5a, 03 marks), W23 (Q3c, OR, 07 marks)
2. **What are the major sources of current harmonics? / Discuss harmonic sources.**
    - Appeared in: W22 (Q3b, OR, 04 marks), S25 (Q4c, 07 marks), W24 (Q3a, OR, 03 marks)
3. **Discuss harmonics in a Thyristor-Controlled Reactor (TCR).**
    - Appeared in: W22 (Q4b, OR, 04 marks), W24 (Q3c, OR, 07 marks)
4. **What are inter-harmonics and sub-harmonics?**
    - Appeared in: S25 (Q5b, OR, 04 marks), W23 (Q3b, OR, 04 marks), W24 (Q3b, OR, 04 marks)
5. **Compare harmonics in rotating machines with arc furnace loads. / Illustrate harmonics in arc furnace loads and a rotating machine.**
    - Appeared in: W23 (Q4a, 07 marks), S25 (Q3c, OR, 07 marks)
6. **Discuss harmonics due to inrush current in a transformer.**
    - Appeared in: S25 (Q3b, OR, 04 marks)
7. **Discuss the K-factor rating for a transformer.**
    - Appeared in: S23 (Q3a, OR, 07 marks), W23 (Q4c, OR, 07 marks)

Other Important Questions:

1. **Explain the significance of pulse-width modulation (PWM).**
    - Appeared in: S25 (Q3a, OR, 03 marks)
2. **What do you mean by the order of harmonics? When will even-order harmonics be present in the system? Explain its effect on an induction motor.**
    - Appeared in: W22 (Q2c, 07 marks)
3. **Discuss harmonics in transformers.**
    - Appeared in: S23 (Q3c, 07 marks)
4. **Discuss switched-mode power supply and pulse-width modulated adjustable speed drives as a source of harmonics.**
    - Appeared in: W23 (Q4c, 07 marks)
5. **Compare the harmonics due to DC drives and AC drives.**
    - Appeared in: W23 (Q4a, OR, 07 marks), W24 (Q5b, 04 marks)
6. **Explain harmonics effects in a 3-Phase Transformer.**
    - Appeared in: S22 (Q4a, OR, 03 marks), W24 (Q4a, OR, 03 marks)
7. **Discuss the first summation law for combining harmonics.**
    - Appeared in: W23 (Q1b, 07 marks)

Unit 5: Utility Harmonics Regulations and Standards

Repeated Questions:

1. **Compare IEEE 519-1992 and IEC 61000-Series Standards. / Give the differences between them.**
    - Appeared in: S25 (Q4b, 04 marks), S22 (Q5a, 03 marks), W24 (Q5a, OR, 03 marks)
2. **Discuss harmonics limits.**
    - Appeared in: S25 (Q4a, 03 marks), W23 (Q4b, 07 marks)
3. **What is THD? Explain the Power Quality Standards for THD.**
    - Appeared in: S22 (Q4b, OR, 04 marks), W22 (Q2a, 03 marks), W24 (Q4b, 04 marks)
4. **Discuss in detail the IEEE 519 and IEC 61000 series standards for Harmonics.**
    - Appeared in: S23 (Q4c, OR, 07 marks)
5. **Discuss the application of harmonics standards for utility systems.**
    - Appeared in: W23 (Q4b, OR, 07 marks), W24 (Q4b, OR, 04 marks)

Other Important Questions:

1. **Enlist any 3 IEEE standards associated with Power Quality.**
    - Appeared in: S23 (Q4a, 07 marks)
2. **Explain the philosophical differences between IEEE 519-1992 and IEC 61000-Series Standards.**
    - Appeared in: S25 (Q4b, 04 marks)

Unit 6: Harmonic Filters

Repeated Questions:

1. **List out types of harmonic filters. / Classification of filter circuits.**
    - Appeared in: S25 (Q4a, OR, 03 marks), W23 (Q5a, OR, 03 marks)
2. **Compare tuned and damped harmonic filters. / Compare various aspects of Single Tuned filter with Damped filter.**
    - Appeared in: S25 (Q4b, OR, 04 marks), S23 (Q4c, 07 marks)
3. **Explain/Demonstrate the design of single-tuned filters. / Explain single-tuned filter for harmonic reduction.**
    - Appeared in: S25 (Q4c, OR, 07 marks), W23 (Q5b, 07 marks), W22 (Q5b, OR, 04 marks)
4. **Explain the role of Harmonic Filters in Harmonics Mitigation.**
    - Appeared in: S22 (Q3b, 04 marks), W24 (Q4a, 03 marks)

Other Important Questions:

1. **Discuss designing of a single-tuned filter.**
    - Appeared in: W23 (Q5b, 07 marks)
2. **Discuss the undesirable effects of harmonics. (This is also a key topic from Unit 4, often linked to the *need* for filters).**
    - Appeared in: S25 (Q4c, 07 marks), W23 (Q5a, 03 marks)

Unit 7: Monitoring Power Quality

Repeated Questions:

1. **Discuss/Write a note on a Harmonic analyzer. / Discuss Power system harmonic analyzer.**
   - Appeared in: S25 (Q5c, OR, 07 marks), S22 (Q4a, 03 marks), W22 (Q5c, OR, 07 marks), W23 (Q5c, 07 marks), W24 (Q5c, 07 marks)
2. **Write a short note on a true RMS meter.**
   - Appeared in: S25 (Q5a, 03 marks), W22 (Q4b, OR, 04 marks)
3. **Explain the features of flicker meters.**
   - Appeared in: S25 (Q5b, 04 marks), W22 (Q5b, OR, 04 marks)
4. **Explain the working of an RMS Meter and a Flicker Meter with necessary diagrams.**
   - Appeared in: S22 (Q5c, 07 marks), W24 (Q4c, OR, 07 marks)
5. **Describe the objectives and procedures for performing power quality monitoring.**
   - Appeared in: S25 (Q5c, 07 marks), W22 (Q5c, OR, 07 marks)

Other Important Questions:

1. **Explain the application of synchronous condensers.**
   - Appeared in: S25 (Q5a, OR, 03 marks), W22 (Q4a, OR, 03 marks)
2. **What are inter-harmonics and sub-harmonics? (Also listed in Unit 4, but relevant for measurement).**
   - Appeared in: S25 (Q5b, OR, 04 marks)
3. **Discuss the measurement of the frequency response of instrument transformers.**
   - Appeared in: W23 (Q5c, OR, 07 marks), W24 (Q5c, OR, 07 marks)
4. **Discuss the need for measuring Harmonic Voltage and Current.**
   - Appeared in: S23 (Q5a, OR, 07 marks)
5. **Explain the following terms: i) Point of Common Coupling, ii) Short Circuit Ratio.**
   - Appeared in: S23 (Q5b, OR, 07 marks)
6. **Explain the role of Synchronous Condenser and Capacitor bank.**
   - Appeared in: S22 (Q5b, OR, 04 marks)
7. **Explain the Power Quality Monitoring Standards used in Power Quality.**
   - Appeared in: S22 (Q5c, OR, 07 marks)
8. **Give the Difference between Shunt and Series Active Power Filter.**
   - Appeared in: S22 (Q5b, 04 marks)

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