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**BTECH**  
**(SEM VII) THEORY EXAMINATION 2024-25**  
**POWER QUALITY AND FACTS**

TIME: 3 HRS

M.MARKS: 100

**Note:** Attempt all Sections. In case of any missing data; choose suitably.

## SECTION A

1. Attempt all questions in brief.

2 x 10 = 20

Q no.	Question	CO	Level
a.	What are long-duration voltage variations?	1	K1
b.	Define voltage fluctuation.	1	K1
c.	What are common sources of voltage sag?	2	K2
d.	Name two solutions to mitigate voltage sag at the end-user level.	2	K1
e.	What are atmospheric transients?	3	K2
f.	Mention one device used for overvoltage protection.	3	K1
g.	What does FACT stand for in power systems?	4	K2
h.	Name two types of FACT devices.	4	K3
i.	What are the effects of harmonics on transformers?	5	K2
j.	What is one technique for mitigating harmonics?	5	K1

## SECTION B

2. Attempt any three of the following:

10 x 3 = 30

Q no.	Question	CO	Level
a.	Explain the key terms and definitions associated with power quality, including transients, long-duration voltage variations, short-duration voltage variations and other phenomena.	1	K2
b.	What are the primary sources of voltage sag, such as motor starting, arc furnaces, and fault clearing? Explain their impact on power system performance and end-user equipment.	2	K2
c.	Describe the sources of transient over voltages in power systems, including atmospheric and switching transients.	3	K3
d.	Define FACTS (Flexible AC Transmission Systems) and explain their role in power flow control. Provide an overview of various FACT controllers.	4	K3
e.	What are the causes of harmonics in electrical systems, and how do current and voltage harmonics differ? Discuss their measurement techniques in detail.	5	K2

## SECTION C

3. Attempt any one part of the following:

10 x 1 = 10

Q no.	Question	CO	Level
a.	Discuss the impact of voltage fluctuations and waveform distortions on electrical equipment performance and power system stability.	1	K1
b.	Describe the causes and characteristics of power frequency variations and their potential effects on sensitive electrical equipment and industrial processes.	1	K2



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**4. Attempt any one part of the following:****10 x 1 = 10**

Q no.	Question	CO	Level
a.	How can the performance of voltage sag be estimated, and what are the principles of its protection? Discuss in detail the methods and tools used for this purpose.	2	K2
b.	Discuss various solutions for mitigating voltage sag at the end-user level, such as isolation transformers, voltage regulators, static and rotary UPS systems, and active series compensators.	2	K1

**5. Attempt any one part of the following:****10 x 1 = 10**

Q no.	Question	CO	Level
a.	What are the effects of neutral voltage swings and UPS switching transients on power system stability and equipment performance? Provide examples and mitigation techniques.	3	K3
b.	Explain the various devices used for overvoltage protection, highlighting their working principles and applications in modern power systems.	3	K2

**6. Attempt any one part of the following:****10 x 1 = 10**

Q no.	Question	CO	Level
a.	Discuss the types of FACT devices, such as SSC, SVC, TCSC and their applications in power systems.	4	K3
b.	Derive the basic relationship for power flow control in a transmission line using FACTS devices.	4	K2

**7. Attempt any one part of the following:****10 x 1 = 10**

Q no.	Question	CO	Level
a.	Explain the effects of harmonics on transformers, AC motors, capacitor banks, cables, and communication lines.	5	K2
b.	Discuss harmonic mitigation techniques, including both passive and active solutions. Provide examples of their applications in modern power systems.	5	K3