

M.E. ELECTRICAL ENGINEERING FIRST YEAR SECOND SEMESTER EXAM 2025

SELECTED TOPICS IN POWER SYSTEM

Time: Three Hours

Full Marks: 100

Answer question number 1 and any five questions from the rest

2 marks reserved for well-organized answers

1. Answer any six questions:

[6 x 3]

- i) Explain why power quality has emerged as an important topic in recent years.
- ii) Distinguish between stationary and nonstationary signals.
- iii) Explain why the use of QV curve is more convenient for voltage stability study.
- iv) Explain how distributed windings can reduce harmonic voltage in rotating machines.
- v) Explain what you understand by V2G technology in smart grid.
- vi) Explain why islanding detection is necessary in microgrid.
- vii) What are the major challenges in a smart grid?
- viii) What do you understand by positive and negative sequence harmonic components?

2. i) Discuss how transformers can be operated in harmonic environment.

[6]

- ii) Determine the Fourier series coefficients of the following waveform and calculate the rms value and total harmonic distortion of the waveform shown in Fig. 1.

[10]

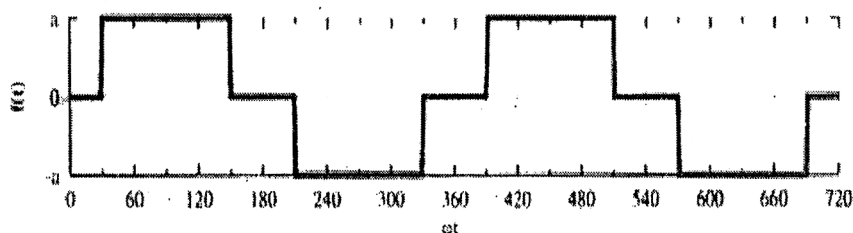


Fig. 1

3. i) List the major power quality disturbances.

[4]

- ii) What are the common causes of voltage sag and voltage swell?

[6]

- iii) Discuss the common methods for mitigation of voltage sag.

[6]

[Turn over

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4. i) Derive the expression for the instantaneous power when sinusoidal voltage source supplies non-linear load. What are harmonic power and displacement power factor? [6+3]
ii) What do you understand by Type I and Type II control in DVR? Explain why it is not possible to maintain load voltage same as that of the source voltage for purely resistive load if the DVR supplies only reactive power. [3+4]
5. i) Discuss the major advantages of smart grid over traditional grid. [6]
ii) Discuss the techniques that can be adopted to secure smart grids against cyber-attack. [6]
iii) Explain the application of cloud computing in smart grid. [4]
6. i) Explain what you understand by microgrid. [6]
ii) Explain why fault detection in microgrid is more difficult compared to traditional grid. [4]
iii) Discuss electromagnetic and electrostatic energy storage systems. [6]
7. i) Draw and explain PV curve. Derive the necessary equations. What is the constraint for obtaining real solutions of voltage? [10]
ii) Discuss how voltage collapse can be prevented. [6]
8. i) Explain what you understand by small signal stability in power system. How small signal stability can be categorized? [4+2]
ii) Analyze the small signal stability of a single machine infinite bus system and find the expressions for natural frequencies and damping ratio. [10]