

# ELECTRICAL POWER TRANSMISSION AND DISTRIBUTION

## SECTION A [40 MARKS]

Attempt **ALL** the Questions in this Section.

### SECTION AI

**Write the correct alternative in the answer booklet provided (2 marks @)**

1. Transmission efficiency increases as
  - A) voltage decreases but power factor increases.
  - B) voltage increases but power factor decreases.
  - C) voltage and power factor both decrease.
  - D) voltage and power factor both increase.
2. Strain type insulator are used where the conductor are
  - A) dead ended.
  - B) at intermediate anchor towers.
  - C) any of the above.
  - D) none of the above.
3. The disadvantage of constant voltage transmission is
  - A) Short circuit current of the system is increased
  - B) Load power factor in heavy loads
  - C) Large conductor area is required for same power transmission
  - D) all of the above.
4. In overhead transmission lines, the effect of capacitance can be neglected when the length of line is less than
  - A) 80 km
  - B) 100 km
  - C) 160 km
  - D) 200 km.
5. The effective resistance of a conductor will be the same as 'ohmic resistance' when
  - A) Current is uniformly distributed in the conductor cross-section.
  - B) Current is in true sine wave from.
  - C) Voltage is low.
  - D) Power factor is unity.
6. The voltage of single-phase supply to residential consumers is
  - A) 110V
  - B) 210V
  - C) 230V
  - D) 400V
7. The distributors for residential areas are.
  - A) Single phase.
  - B) Three phase three wire.
  - C) Three phase four wire.
  - D) None of the above.
8. When a conductor carries more current on the surface as compared to the core, its due to
  - A) Corona.
  - B) Skin effect.
  - C) Unsymmetrical fault.
  - D) All of the above.
9. The following system is not generally used electrical power transmission and distribution.
  - A) 1-Phase 3 wire
  - B) 1-Phase 4 wire

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- C) 3-Phase 3 wire  
D) 3-Phase 4 wire
10. For transmission of power over a distance of 200km, the transmission voltage should be:
- A) 11kV                      B) 66kV                      C) 33kV                      D) 132kV

### SECTION A II

Briefly explain the following terms used in electrical power transmission and distribution. **(2 marks @)**

- i) Line voltage.
- ii) Phase voltage.
- iii) Voltage regulators.
- iv) Phase current.
- v) Insulators.
- vi) Transformers.
- vii) Stay wires.
- viii) Voltage regulation.
- ix) Efficiency.

### SECTION B

#### SECTION B [60 MARKS]

Attempt **ONLY THREE** questions in this Section.

#### Question 1

- a) Mention any three components of electrical power transmission. **(3 marks)**
- b) Draw a well labelled diagram showing the structure of a power system. **(4 marks)**
- c) Use the structure of power system to explain the following.
  - i) Primary transmission. **(2 marks)**
  - ii) Secondary transmission. **(2 marks)**
- d) List the four parameters that govern the performance of a transmission line. **(4 marks)**
- e) Differentiate between transmission lines and distribution lines. **(5 marks)**

#### Question 2

- a) Distinguish between power lines and cables **(5 marks)**
- b) Outline **two** advantages and **two** disadvantages of overhead transmission over underground transmission **(4 marks)**
- c) List down three differences between solid and stranded conductors **(3 marks)**
- d) Mention **five** properties of a good supporting structure for an overhead transmission line **(5 marks)**
- e) List down **three** disadvantages of wood as a supporting structure. **(3 marks)**

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### Question 3

- a) Mention any **four** types of reactive compensation. **(4 marks)**
- b) Consider a three-phase, **400-kV**, 50-Hz transmission line that has a series inductive reactance of  $0.30 \Omega/\text{km}$  and a shunt admittance of  $3.75 \times 10^{-6} \text{ S}/\text{km}$ . If the line is 300 km long, determine the following.
- i) Surge impedance  $Z_c$ . **(6 marks)**
  - ii) Propagation constant,  $\gamma$  **(2 marks)**
  - iii) ABCD constants. **(4 marks)**
  - iv) Wavelength. **(2 marks)**
  - v) SIL. **(2 marks)**

### Question 4

- a) With the aid of diagrams, distinguish between Single-core conductor channel and Single-core sheath channel;
- b) Outline the advantages of oil-filled cables.
- c) List down **five** factors that affect the sag of a transmission line;
- d) A transmission line has a span of 250 m between level supports. The conductor has an effective diameter of 1.69 cm and weighs 0.875 kg/m. Its ultimate strength is 9040 kg. If the conductor has ice coating of radial thickness 1.17 cm and is subjected to a wind pressure of  $3.7 \text{ gm}/\text{cm}^2$  of projected area, calculate sag for a safety factor of 2. Weight of 1 c.c. of ice is 0.93 gm.

### Question 5

- a) Define power system protection. **(2 marks)**
- b) Name the **six** categories of protection zones possible in a power system using the concept of selective coordination **(3 marks)**
- c) List any **four** power system protection devices. **(4 marks)**
- d) Define the following terms
- i) Ferranti effect. **(1 mark)**
  - ii) Skin effect. **(1 mark)**
  - iii) Corona effect. **(1 mark)**
- e) Mention **four** factors that affect Corona. **(4 marks)**
- f) List **four** ways of reducing Ferranti effect **(4 marks)**