

Reg. No. :

**Question Paper Code : 61146**

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

Elective

Power Systems Engineering

PS 5004 – PRINCIPLES OF ELECTRIC POWER TRANSMISSION

(Regulations 2017)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the main requirements of the insulating materials used for cable?
2. List out the disadvantages of corona?
3. Why should the reactive power transfer in lines be minimized?
4. Why are insulators used with overhead lines?
5. Mention the demerits of HVDC transmission.
6. Why transmission lines are 3 phase 3-wire circuits while distribution lines are 3 phase 4 wire circuits?
7. State the advantages of EHVAC transmission system.
8. Why the effective resistance is more than the static resistance of a transmission line?
9. List the factors that governing the capacitance of a transmission line.
10. What is the effect of bundled conductors on transmission line inductance?

PART B — (5 × 13 = 65 marks)

11. (a) (i) Why does a transmission line have resistance, inductance, and capacitance? Explain the advantages of bundled conductors when used for overhead lines. (5)
- (ii) A 220kV, 50Hz, 200km long transposed three phase line has its conductors on the corners of triangle with sides 6m, 6m and 10m. The conductor radius is 1.81cm. Find the capacitance per phase per km of the line. (8)

Or

- (b) Draw and explain in detail about the structure of typical electric power system with various voltage levels.
12. (a) Derive the capacitance of a three-phase overhead line and single core cable.

Or

- (b) Derive the inductance of single phase two wire line and three phase overhead line.
13. (a) (i) A three phase 220kV, 50Hz transmission line consists of 1.5cm radius conductor spaced 2m apart in equilateral triangular formation. If the temperature is 40°C and atmospheric pressure is 76cm. Calculate the corona loss/km of the line. Take  $m_0 = 0.85$ . (8)

- (ii) Discuss briefly about the  $I^2R$  loss and corona loss. (5)

Or

- (b) Explain the formation of corona critical voltages, corona loss, advantages, disadvantages and methods to reduce the effect of corona. (13)
14. (a) A string of eight suspension insulators is to be graded to obtain uniform distribution of voltage across the string. If the capacitance of the top unit is 10 times the capacitance to ground of each unit determine the capacitance of the remaining seven units. (13)

Or

- (b) Explain the various causes of power frequency over-voltages in EHV system and the design aspects of EHV lines.

15. (a) An existing 400 kV 3-phase AC line transmitting a power 100MW is converted into bipolar DC line. Evaluate the DC voltage/pole and DC line losses, if the resistance of each conductor is 0.01 ohm. Assume power factor = 0.90. (13)

Or

- (b) What are the methods of testing insulators? Explain the different interconnection methods of HVDC into AC system. Mention its advantages and disadvantages.

PART C — (1 × 15 = 15 marks)

16. (a) List out the advantages of higher operating voltage. And then compare EHVAC system with HVDC system. Discuss in detail the problems associated with EHV AC transmission. Also state how these problems are being solved? Describe briefly the types of HVDC links.

Or

- (b) Explain with a neat layout the modern EHV system. What is the highest voltage level available in India for EHV transmission? Determine the capacitance and charging current per unit length of an overhead transmission line having 3-phase, 3-wire structure with horizontal structure. Further assume that the radius of the conductors is 15mm and spacing between two closely situated conductors is 2.5m.

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