**Total No. of Questions : 8]**

**SEAT No. :** ____

**P614**

**[Total No. of Pages : 3**

# [5869]-236
# S.E. (Electrical)
# POWER SYSTEMS - I
## (2019 Pattern) (Semester - IV)

***Time : 2½ Hours]*** ***[Max. Marks : 70***

***Instructions to the candidates:***

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

***Q1)*** a) Explain what are factors to be consider for selecetion of span length hence state factors affecting sag of transmission line. **[5]**

b) Describe advantages and limitations of following insulators. **[6]**

i) Pin insulator.

ii) Shackle insulators.

iii) Strain insulators.

c) Each conductor of 3 phase line is suspended by 4 suspension insulators. If voltage distribution across second and third insulators from top are 13.6 kV and 17.8 kV respectively. Find voltage between the conductors.**[6]**

OR

***Q2)*** a) State following statements are True of False. **[5]**

i) Guard rings are used to reduce the earth capacitance in suspension insulators.

ii) Bushings used for large capacity of transformers are generally solid porcelain bushings.

iii) Slant sag can be calculated by dividing vertical sag by cos θ.

iv) In overhead transmission lines, tension at any point on conductor will act horizontally.

v) In suspension insulator string, disc nearest to the conductor is highly stressed.

b) A transmission line has a span of 220 m between level supports. The conductor has cross sectional area of 2.5 $cm^2$. The tension in the conductor is 2000 kg. If the weight of the conductor is 2 kg/m and wind pressure is 2.05 kg/m calculate vertical sag. **[6]**

c) A 3 phase 80 kV transmission line is supported by 3 suspension insulators. If the ratio of shunt capacitance to self-capacitance is 0.68 Determine.**[6]**

i) Voltage distribution across each unit.

ii) String efficiency.

***P.T.O.***

***Q3)*** a) Write a short note on. **[6]**

i) Skin effect.

ii) Proximity effect.

b) Derive an expression for the inductance of three phase overhead transmission line when conductors are unsymmetrical spaced but transposed. **[6]**

c) A three phase transmission line has its conductors at the corner of equilateral triangle with side of 3 meter. The diameter of each conductor is 1.6 centimetre. Find inductance per phase per kilometre of line. **[6]**

OR

***Q4)*** a) Derive an expression for flux linkages due to single current carrying conductor. **[6]**

b) Explain the concept of GMD and GMR for inductance calculation. **[6]**

c) What is meant by transposition of conductors in an overhead line? Why it is essential? How it is carried out? **[6]**

***Q5)*** a) Derive an expression for capacitance per kilometre of single phase overhead line having distance 'D' beteween the conductors and 'r' is the radius of each conductor. **[6]**

b) Explain the concept of self GMD or GMR for capacitance calculation. **[5]**

c) Calculate the capacitance of 100 kilometre long three phase, 50 Hz transmission line consisting of three conductors, each of 2 centimetre diameter and spaced 2.5 meter at the corner of an equilateral triangle. **[6]**

OR

***Q6)*** a) Derive an expression for the capacitance to neutral of a three phase line with equilateral spacing. **[6]**

b) A single phase transmission line has two parallel conductors 3 meter apart, radius of each conductor is 1 centimetre. Calculate the capacitance of line per kilometre. **[5]**

c) Define term electric potential. Derive an expression for electric potential for single charged conductor. **[6]**

***Q7)*** a) Derive the expression for ABCD constants of medium transmission line considering nominal 'π' model of the line. **[6]**

b) Calculate ABCD constants for three phase 50 Hz transmission line with following line parameters. **[6]**

Use Nominal 'T' method.

R=24 Ω, L=0.192H C=1.28*$10^{-6}$F G=0

c) State performance parameters of transmission line hence explain how ABCD constants are useful for determining these parameters. **[6]**

OR

***Q8)*** a) Define generalised circuit constants of transmission line, write general relationship between sending end and receiving end quantities hence state properties of transmission lines from ABCD constants. **[6]**

b) An overhead 3-phase short transmission line delivers 4.5 MW at 22kV with 0.78 p.f. lagging at receiving end. The resistance & reactance of each conductor is 5 Ω & 6 Ω respectively. Determine: Sending end voltage, sending end power factor and percentage regulation. **[6]**

c) Draw neat circuit diagram and phasor diagram of following transmission line models. **[6]**

i) Medium transmission line Nominal 'T' model.

ii) Medium transmission line Nominal 'π' model.

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