Total No. of Questions : 8]

SEAT No. :

PB3606

[Total No. of Pages :4

[6261]-11
S.E. (Electrical)
POWER SYSTEMS - I
(2019 Pattern) (Semester-IV) (203145)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6, Q. 7 or Q. 8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) State various components of overhead line hence discuss their use. **[6]**

b) Calcualate weight of conductor per meter and total weight if ultimate tensile strength is 5800 kg. Sag is 2.8 m, factor fo safety is 3 and line has span of 350 meters. **[6]**

c) Explain with neat sketch, working and application of **[6]**

i) Shackle insulator

ii) Post insulators

OR

Q2) a) Explain following methods used to improve string efficiency **[6]**

i) Capacitance grading

ii) Static shielding

b) Derive the expression for sag of transmission line when supports are at unequal level hence explain effect of ice loading on sag. **[6]**

c) A three phase line is supported by a string of 4 suspension insulators. The voltage across first and last units of a string are 10.9 kV and 26.8 kV respectively. If the ration of capacitance of each insulator unit to capcitance to earth of each section is 5:1 calculate line voltage and string efficiency.**[6]**

P.T.O.

Q3) a) Prove that, GMR for single phase two wire line is given by r' = 0.7788 *r. **[6]**

Where, r' = GMR of conductor and r = radius of conductor.

b) Calculate inductance per km and total inductance of three phase 250 km long line when conductors are arranged in the form of triangle with sides 4m, 4.5 m and 6.2 m. The conductors are regularly transposed and diameter of each conductor is 3 cm. **[6]**

c) With neat sketch, explain necessity of transposition. **[5]**

OR

Q4) a) Derive the expression for inductance of 3 phase line when conductors are symmetricallly spaced in the form of equilateral triangle **[6]**

b) What are bundle conductors, explain their advantages. **[5]**

c) 1 phase 2 wire line, 400 km long with 2.5 cm diameter conductors spaced 4.5 m apart from each other, calcualte **[6]**

i) Inductance of line per km

ii) Total Inductance

iii) Loop inductance per km

iv) Total loop inductance

Q5) a) With neat diagram, Derive the expression of capcitance of single phase transmission line considering effect of earth hence explain what is method of images. **[9]**

b) A single phase 66 kV, 50 Hz, 20 km long transmission line is 8.4 m above the ground. The diameter of each conductor is 2 cm and is separated by 6 m horizontally. Calculate **[8]**

i) Capacitance between conductors and charging current with effect of ground

ii) Capacitance between conductors and charging current neglecting effect of ground

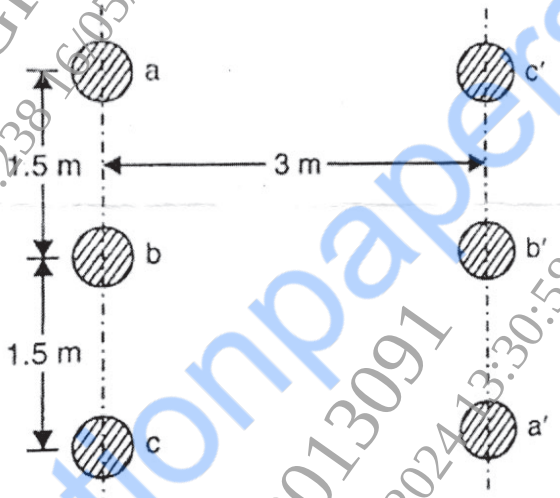
OR

Q6) a) Derive the expression for capcitance of three phase transmission line with unsymmetrical spacing with transposition, hence explain concept of GMD in capacitance calculations. **[8]**

b) 3 phase, 110 kV, 100 km 50 Hz overhead double circuit transmission line conductors are placed in vertical plane as shown in figure. The conductor diameter is 1.5 cm. Assuming complete transposition of the line, calculate **[9]**

i) Capacitance per phase (line to neutral)

ii) Charging current per phase



Q7) a) ABCD constants of a 3 phase 132 kV, 50 Hz transmission line are as follows **[10]**

$A = D = 0.99 \angle 0.18^{\circ}$, $B = 55 \angle 69^{\circ}\ \Omega$ and $C = 315 \times 10^{-6} \angle 90^{\circ}$ S If the line delivers a load of 50 MW at 0.8 lagging power factor at the receiving end, calculate

i) Sending end voltage

ii) Sending end current

iii) Sending end power factor

iv) Line efficiency

v) Line regulation

b) Deduce the relation between sending end and receiving end quantities of a medium transmission line considering nominal 'T' model of the line, draw neat phasor diagram. **[8]**

OR

Q8) a) Justify the following statements. **[6]**

i) Under lagging load condition, receiving end voltage of the line is always less than sending end voltage.

ii) With increase in load power factor, there is increase in efficiency of line.

iii) Nominal 'π' network of transmission line is always symmetrical and reciprocating network.

b) Draw neat sketches of following representations of transmission lines, clearly mention all parameters in it **[6]**

i) Short transmission line

ii) Medium transmission line with Nominal 'T' network

iii) Medium transmission line with Nominal 'π' network

c) Following data refers to 50 Hz, 3 phase transmission line of length 25 km with sending end voltage of 132 kV. Load delivered at receiving end is 120 MW at 0.8 pf lagging. **[6]**

Resistance of conductor = 0.6 Ω/km

Reactance of conductor = 0.75 Ω/km

Calculate

i) Line current

ii) Sending end voltage

iii) Line losses