Total No. of Questions : 8]

SEAT No. :

PA-1208

[Total No. of Pages : 4

[5925]-230

S.E. (Electrical)

POWER SYSTEMS - I

(2019 Pattern) (Semester - IV) (203145)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

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

Q1) a) Define term string efficiency and explain various methods of improving string efficiency **[6]**

b) Write a short note on : **[6]**

i) Pin Type Insulator

ii) Strain type insulator.

Write application of each type of insulator.

c) A transmission line conductor at river crossing is supported from two towers at heights 50 m and 80 m above water level. The horizontal distance between the towers is 300 m. If ultimate strength in the conductor is 1500 kg with safety factor of 2. Find distance of tallest point and lowest point on conductor above the water level. Weight of conductor is 0.75 kg/m, hence calculate sag at both ends on conductor.

[6]

OR

Q2) a) Derive an expression for sag in case of overhead transmission line when the supports are at unequal level. Explain the meaning of every terms in derivation. Draw a neat diagram. **[6]**

P.T.O.

b) A string of three units suspension insulators observed to have a voltage distribution on top disc 9kV and middle disc of 12 kV. Find **[6]**

i) Ratio of shunt capacitance to self capacitance.

ii) Voltage distribution across the bottom most disc.

iii) Total system voltage.

iv) String efficiency.

c) Explain effect of wind and ice loading taken into account while sag calculation. **[6]**

Q3) a) Derive an expression for loop inductance of single phase overhead lines. Draw a neat diagram. **[6]**

b) Explain in brief with neat diagram the following effects

i) Skin effect

ii) Proximity effect

Hence state what are the factors responsible for producing these effects and how? **[6]**

c) In a three phase transmission lines, three conductors are spaced at equal distance from each other i.e. 2.5 meter. The diameter of conductor is 1.3 centimeter. Find inductance per kilometer length of line. **[5]**

OR

Q4) a) Derive an expression for inductance of three phase transmission line with symmetrical spacing . Draw a neat diagram. **[7]**

b) Explain necessity of transposition in transmission line. **[4]**

c) Three conductors of a three phase transmission line are arranged at the corner of a triangle of side 3 ,3.5 and 4.2 meter respectively. Calculate inductance per kilometer of the line when conductors are regularly transposed Consider diameter of each conductor of 1.5 centimeter.

[6]

Q5) a) Derive the expression for capacitance to neutral of a three-phase line with equilateral spacing. Draw a neat diagram. **[6]**

b) A single phase transmission line has two parallel conductors 3.5 meter apart from each other. The radius of each conductor is 1.5 centimeter. Calculate capacitance of each line per kilometer. Assume $\varepsilon_0 = 8.854 * 10^{-12}$ (Farad/meter) **[5]**

c) Explain the effect of GMR and GMD for capacitance calculations of overhead transmission lines. **[6]**

OR

Q6) a) What do you understand by electric potential? Derive an expression for electric potential at **[6]**

i) Capacitance per phase.

ii) Conductor in a group of charged conductors.

b) A three phase, 110kV, 50 Hz overhead line conductors are placed in horizontal plane. Each conductor diameter is 1.5 centimeter. If the line length is 1000 kilometer. Assume complete transposition of line. Calculate

i) Capacitance per phase

ii) Charging current per phase,

[6]

c) What is the difference in calculation of self GMD or GMR of inductance and capacitance? **[5]**

Q7) a) Give classification of transmission line. Explain the effect of load power factor on regulation and efficiency. **[6]**

b) A three phase transmission line, 132 kV is connected to a 50 MW load at power factor of 0.85 (lagging). The line constants of 80 km line are $Z = 96 \angle 78^\circ (\Omega)$ and $Y = 0.001 \angle 90^\circ (S)$. Using nominal "T" method calculate A, B, C and D constants of transmission line. **[6]**

c) Write a short note on Ferranti effect. **[6]**

OR

Q8) a) Obtain the relationship between sending end voltage and current in terms of receiving end voltage and current for a medium transmission line using "nominal Π" method .Draw a neat phasor diagram. **[6]**

b) A single phase overhead transmission line delivers 1100kW at 33k Vat 0.86 power factor lagging. The total resistance and inductive reactance of line are 10Ω and 15Ω respectively. **[7]**

Determine

i) Current.

ii) Sending end voltage.

iii) Sending end power factor.

iv) Transmission efficiency.

v) Voltage regulation.

c) Derive an expression for ABCD constants of short transmission line. **[5]**