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]**

Total No. of Questions : 8]

SEAT No. : ____

P-1502

[Total No. of Pages : 3

[6002]-130
S.E. (Electrical)
POWER SYSTEM - 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 and Q.7 or Q.8.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn whenever necessary.***
4) ***Make suitable assumption whenever necessary.***

Q1) a) Define term 'Sag' and explain factors affecting sag of transmission line. **[5]**

b) With neat diagram, explain construction and application of any two of the following type of insulators. i) Pin Type Insulator ii) Strain type insulator. Write application of each type of insulator. **[8]**

c) The weight of the overhead line conductor is 600 kg/km. The ultimate strength is 3000 kg. If the safety factor is 2. Find i) Sag ii) Height above which conductor should be supported if ground clearance required is 6 meters. **[5]**

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 term in derivation. Draw a neat diagram. **[6]**

b) How wind and ice loading affect the presence of sag. **[6]**

c) A string of suspension insulators consists of four units. The capacitance between each link and earth is one tenth of the self-capacitance of a unit. The voltage between line conductor and earth is 100 kV. Find i) Voltage distribution across each unit ii) String efficiency. **[6]**

Q3) a) Derive an expression for internal and external flux linkages of a conductor caring current 'I' ampere. **[8]**

b) Explain the concept of Geometric mean radius (GMR) or self GMR in case of transmission lines. **[4]**

c) A 50 Hz, overhead transmission line consisting of three conductors each of diameter 1.24 centimeter and spaced 2 meters apart. Calculate the inductance per phase per kilometer when conductors are equilateral spacing. **[5]**

P.T.O.

OR

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

b) Write a short note on proximity effect. **[4]**

c) A three phase 50 Hz overhead transmission line consist of three conductors each of diameter 0.3 centimeter. The spacing between the conductors are as follows. Between A and B = 4 meter, B and C = 4.5 meter and between A and C = 5.2 meter. Find inductance and inductive reactance per phase per kilometer of line. **[6]**

Q5) a) Derive the expression for capacitance to neutral of a single-phase transmission line considering effect of earth. **[8]**

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

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

OR

Q6) a) Derive an expression for line to neutral capacitance of three phase overhead line with unsymmetrical spacing of conductors. Assume complete transposition of conductors. Draw a neat transposition diagram. **[8]**

b) A three phase, 110 kV, 50 Hz overhead line conductors are placed in a horizontal plane. The conductor diameter is 1.5 centimeter if line length is 120 kilometers, assume completer transposition of line. Calculate i) Capacitance per phase ii) Charging current. **[8]**

c) Define term electric potential. **[2]**

Q7) a) Give classification of transmission line with voltage, length, and line parameters. **[5]**

b) A balanced three phase load of 30 MW is supplied at 132 kV, 50 Hz and 0.85 power factor lagging by means of transmission line. The series impedance of single conductor is (20+j 52) ohm and total phase to neural admittance is $315*10^{-6}$ Siemens. Using nominal "T" method determine A, B, C and D constants of the line. Write units of each constant. **[7]**

c) With a neat circuit diagram, derive an expression for A, B, C and D constants of short transmission line. Draw a neat phasor diagram. **[5]**

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 T" method. Draw a neat phasor diagram. **[7]**

b) A single-phase overhead transmission line delivers 2000 kW at 33 kV at 0.85 power factor lagging. The total resistance and inductive reactance of the line are 10 ohm and 15 ohms respectively. Determine i) Sending end voltage ii) Sending end power factor iii) Transmission efficiency. **[6]**

c) Write a short note on Ferranti effect. **[4]**

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Total No. of Questions : 4]

SEAT No. : ____

PA-4964

[Total No. of Pages : 2

[6008]-212
S.E. (Electrical) (Insem)
POWER SYSTEMS - I
(2019 Pattern) (Semester - II) (203145)

Time : 1 Hour] ***[Max. Marks : 30***

Instructions to the candidates:

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

Q1) a) Define tariff hence state different objectives of tariff. **[5]**

b) Explain what is interconnected grid system hence state its advantages. **[5]**

c) A Daily load on a generating station is as follows. **[5]**

Time (Hrs)	0-5	5-10	10-13	13-18	18-20	20-24
Load (MW)	25	30	40	35	50	25

Draw the load curve and calculate load factor

OR

Q2) a) The maximum demand of a consumer in a year is 400 kW at 0.8 load factor, If the tariff is Rs. 150/ kW of MD + 20 paisa/kWh. Find overall cost/kWh **[4]**

b) Write a note on Availability Based tariff. **[5]**

c) Define the following terms and state their use : **[6]**

i) Load Factor

ii) Demand Factor

iii) Plant Capacity Factor

P.T.O.

Q3) a) Explain in brief working of following equipment's in power station hence state their use in the system. **[6]**

i) Alternators

ii) Protective relays

b) With neat diagram, explain working of AC excitation system used in alternator. **[4]**

c) A 110 kV, 50 Hz. 5 km long underground cable has conductor diameter of 2.5 cm and diameter of lead sheath is 4 cm. Calculate capacitance of cable per phase. Assume $\varepsilon_r = 4.6$. **[5]**

OR

Q4) a) Explain what is necessity of grading of cables hence explain capacitance grading. **[6]**

b) Derive the expression for maximum and minimum dielectric stress in single core cable. **[4]**

c) Explain use of power transformer hence list different specifications written by manufacturer on nameplate of power transformer. **[5]**

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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.