Code No: RR310203 **Set No.1**

III B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEMS-II
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A series capacitor bank is to be installed at the mid point of the 300 Km line. The ABCD constants for 150 Km of the line are$A = D = 0.9534 \angle 0.3^0$ $B = 90.33 \angle 84.1^0$ ohms, and $C = 0.001014 \angle 90.1^0$ mhos. The ABCD constants of the series capacitor bank are $A = D = 1 \angle 0^0$, $B = 146.6 \angle -90^0$ohms, C = 0. Determine the equivalent ABCD constants of the series combination of the line-capacitance-line. [16]

2. (a) Determine the critical disruptive voltage and corona loss for a 3-phase line space operating at 110kV which has conductors of 1.25cm diameter arranged in a 3.05m delta spacing. Assume air density factor of 1.07 and the dielectric strength of air to be 21kV/cm.
   (b) Explain in brief the disadvantages of corona and different methods of reducing corona loss. [8+8]

3. A transmission line has a span of 180m between level supports. The conductor has a cross-section area of 129mm2, weights 1.17 kgf/m and has a breaking stress of 42kgf/mm^2. Calculate the sag for a factor of safety of 5, allowing for a maximum wind pressure of 125kgf/m^2 of projected surface. [16]

4. (a) A single core cable has an inner diameter of 5cms and a core diameter of 1.5cm. Its paper dielectric has a working maximum dielectric stress of 60 kV/cm. Calculate the maximum permissible line voltage when such cables are used on a 3-phase power system. [6]
   (b) A 66kV concentric cable with two inter sheaths has a core diameter 1.8 cm. Dielectric material 3.5 mm thick constitutes the three zones of insulation. Determine the maximum stress in each of the three layers if 20kV is maintained across each of the inner two layers. [10]

5. (a) Explain the causes for low power factor in a system? [6]
   (b) A 3-ϕ, 5KW induction motor has a power factor of 0.75 lagging. A bank of capacitors is connected in delta across the supply terminals and the p.f. is raised to 0.9 lagging. Determine the KVAR rating of the capacitors connected in each phase. [10]

6. What are the various methods of voltage control in a power system, explain with neat sketches and vector diagrams. [16]

7. (a) Explain the harmful effects of short circuit faults on the power system. [6+10]

(b) Two generators are connected to a common bus bar, at which an out going feeder is connected. The generator ratings are 15MVA, 30% and 20MVA, 50% respectively. The percentage reactance of each alternator is based on its own capacity. The bus bar voltage is 12KV. Find the short circuit current that will flow into a complete 3-ϕ short circuit at the beginning of the outgoing feeder.

8. (a) Derive the expression for the fault current and the terminal voltages for a line to ground fault which occurs at the terminals of an unloaded 3-ϕ alternator. Assume that the alternator neutral is grounded through reactance x^n . [8+8]

(b) A 20MVA, 11KV, 3-ϕ 50HZ generator has its neutral earthed through a 5% reactor .It is in parallel with another identical generator having isolated neutral. Each generator has a positive sequence reactance of 20%, Negative sequence reactance of 10% and zero sequence reactance of 15%. If a line to ground short circuit occurs in the common bus-bar ,determine the fault current .

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Code No: RR310203 **Set No.2**

III B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEMS-II
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. Find the ABCD parameters of a 3-phase, 80Km, 50Hz transmission line with series impedance of (0.15 + j 0.28) ohms per Km and a shunt admittance of j $5x10^{-4}$ ohm per Km for the both Π and T networks. [16]

2. (a) Give brief description of corona phenomenon. [8+8]
   (b) Derive the expression for potential gradient at the surface of a conductor of 1-phase transmission line.

3. A transmission line conductor at a river crossing is supported from two towers at heights of 45m and 75m above sea level. The span length is 300m. Weight of the conductor 0.85kg/m. Determine the clearance between the conductor and water at a point midway between towers if the tension in the conductor is 2050 kg. [16]

4. (a) A single core cable has an inner diameter of 5cms and a core diameter of 1.5cm. Its paper dielectric has a working maximum dielectric stress of 60 kV/cm. Calculate the maximum permissible line voltage when such cables are used on a 3-phase power system. [6]
   (b) A 66kV concentric cable with two inter sheaths has a core diameter 1.8 cm. Dielectric material 3.5 mm thick constitutes the three zones of insulation. Determine the maximum stress in each of the three layers if 20kV is maintained across each of the inner two layers. [10]

5. (a) What is the effect of transformer operation on supply power factor? Discuss? [4]
   (b) A synchronous motor improves the power factor a load of 200KW from 0.8 lagging to 0.9 lagging . Simultaneously the motor carries a load of 80KW. Find
      i. the leading KVAR supplied by the motor [4]
      ii. KVA rating of the motor and [4]
      iii. the power factor at which the motor operates? [4]

6. Compare the merits and demerits of voltage control by the methods of ON load and OFF load tap changing transformers. Specify their applications. [16]

7. (a) The line to line voltages of a three phase system measure 50,75, and 100volts.Find the magnitude of the positive and negative sequence components of the delta voltage and the star voltages. [8+8]

(b) Derive the expression for neutral current in a three phase four wire unbalanced load which is connected to a 3ϕ four wire balanced source in terms of symmetrical components.

8. (a) Derive the expressions for sequence impedances and draw the sequence impedance diagrams for a 3-ϕ synchronous generator whose stator winding neutral is solidly grounded. [8+8]

(b) Derive the expressions for sequence impedances and draw the sequence impedance diagrams for a 3-ϕ synchronous generator whose stator winding neutral is un grounded.

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Code No: RR310203 **Set No.3**

III B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEMS-II
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. A 3-phase,50Hz transmission line has resistance, inductance and capacitance per phase of 10ohms, 0.1H and 0.9μF respectively and delivers a load of 35 MW at 132 kV and 0.8 p.f laging. Determine the efficiency and regulation of the line using
   (a) nominal T method
   (b) nominal πmethod. [8+8]

2. (a) What do you mean by critical visual disruptive voltage? [12]
   (b) Find the critical disruptive voltage and the critical voltages for local and general corona on a 3-phase overhead transmission line, consisting of three stranded copper conductors spaced 2.5m apart at the corners of an equilateral triangle. Air temperature and pressure are 21^0C and 73.6 cm Hg respectively. Take conductor dia 10.4mm, irregularity factor 0.85, local and general surface factors 0.7 and 0.8 respectively. [4]

3. (a) What is a sag template? Explain how this is useful for loading of towers and stringing of power conductors. [8+8]
   (b) A transmission line has a span of 200m between level supports. The conductor has a cross-section area of $130mm^2$, weights 1.2 kgf/m and has a breaking stress of 40kgf/mm^2. Calculate the sag for a factor of safety of 5, allowing for a maximum wind pressure of 125kgf/m^2 of projected surface.

4. (a) Derive the formula fpr insulation resistance of aUG cable. [10]
   (b) In a coaxial cable the conductor diameter is 10 mm and the inner shath diameter is 50mm. There are two layers of insulation, the inner layer of dielectric constant 4 and a maximum working gradient of 6kV/mm has a radial thickness of 4.6 mm; the outer layer has dielectric constant 2.5 and maximum voltage gradient 5kV/mm. Calculate the maximum working voltage for the cable. [6]

5. (a) Why is their a phase difference between voltage and current in an ac circuit? Explain the concept of power factor? [5]
   (b) Derive an expression for most economical power factor which may be attained by a consumer? [7+5]
   (c) Explain, why a consumer having low power factor is charged at higher rates?

6. (a) Prove that the voltage angle changes appreciably at the load bus for change in active power of the load and no appreciable change in voltage for change in reactive power of the load . [8+8]

(b) A load of 10000KW at a power factor of 0.8 lagging is supplied by a 3-phase line whose voltage has to be maintained at 33KV at each end. If the line resistance and reactance per phase are 5 ohms and 10 ohms respectively, calculate the capacity of the synchronous condenser to be installed for the purpose.

7. (a) What is the importance of base KVA in short circuit calculations? [6+10]

(b) A generating station has four bus bar sections .Each section is connected to tie bar through 20% reactors rated at 200MVA.Generators of total capacity 100MVA and 20% reactance are connected to each bus bar section. Calculate the MVA fed to a fault under short circuit condition on two of the bus bars.

8. (a) Derive the expression for the fault current and the terminal voltages for a line to ground fault occurs at the terminals of an unloaded 3-ϕ alternator. Assume that the alternator neutral is solidly grounded. [8+8]

(b) A 3-ϕ , 10MVA ,11KV generator with a solidly earthed neutral point supplies a feeder . The positive, negative, and zero sequence impedances of generator and feeder are j1.2, j0.9, j0.4 and j1.0,j1.0,j3.0 respectively. If a fault from one phase to earth occurs on the far end of the feeder , calculate the fault current and line to neutral terminal voltage of the faulted phase.

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Code No: RR310203 **Set No.4**

III B.Tech. I Semester Regular Examinations, November -2005
POWER SYSTEMS-II
(Electrical & Electronic Engineering)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Derive the ABCD constants for long transmission lines. [10]
   (b) Explain briefly classification of transmission lines based on line lengths with neat diagrams. [6]

2. (a) Determine the critical disruptive voltage and corona loss for a 3-phase line space operating at 110kV which has conductors of 1.25cm diameter arranged in a 3.05m delta spacing. Assume air density factor of 1.07 and the dielectric strength of air to be 21kV/cm. [8+8]
   (b) Explain in brief the disadvantages of corona and different methods of reducing corona loss.

3. (a) What is a sag template? Explain how this is useful for loading of towers and stringing of power conductors. [8+8]
   (b) A transmission line has a span of 200m between level supports. The conductor has a cross-section area of $130mm^2$, weights 1.2 kgf/m and has a breaking stress of 40kgf/mm^2. Calculate the sag for a factor of safety of 5, allowing for a maximum wind pressure of 125kgf/m^2 of projected surface.

4. (a) Derive the formula for dielectric stress in an UG cable. [10]
   (b) Single-core, lead covered cable is to be designed for 66kV to earth. Its conductor radius is 10mm and its three insulating materials A,B and C have relative permittivities of 5,4 and 3 respectively and corresponding maximum permissible stresses of 3.8, 2.6 and 2.0 kV/mm (rms) respectively. Find the minimum diameter of the lead sheath. [6]

5. (a) Why is their a phase difference between voltage and current in an ac circuit? Explain the concept of power factor? [5]
   (b) Derive an expression for most economical power factor which may be attained by a consumer? [7+5]
   (c) Explain, why a consumer having low power factor is charged at higher rates?

6. What are the various methods of voltage control in a power system, explain with neat sketches and vector diagrams. [16]

7. (a) What are the advantages of expressing reactances in percentage values.? [7]

(b) Show that a generating plant having N section bus bars each rated at Q KVA with x% reactance, connected on the tie-bar system through bus-bar reatances of b% has a total short circuit KVA on one section of [(Q/x)+Q(N-1)/(bN+x)]100.If the section rating is 50000MVA;x=20% and b=10% find the short circuit KVA with

i. three sections [3]

ii. five sections [3]

iii. Nine sections. [3]

8. (a) Derive the expression for the fault current and the terminal voltages for a line to ground fault occurs at the terminals of an unloaded 3-ϕ alternator. Assume that the alternator neutral is solidly grounded. [8+8]

(b) A 3-ϕ , 10MVA ,11KV generator with a solidly earthed neutral point supplies a feeder . The positive, negative, and zero sequence impedances of generator and feeder are j1.2, j0.9, j0.4 and j1.0,j1.0,j3.0 respectively. If a fault from one phase to earth occurs on the far end of the feeder , calculate the fault current and line to neutral terminal voltage of the faulted phase.

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