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

III B.Tech. I Semester Supplementary Examinations, May -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.
   (b) Explain briefly classification of transmission lines based on line lengths with neat diagrams.

2. (a) What do you mean by critical visual disruptive voltage?
   (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.

3. An overhead line has the following data: span length 185m, difference in levels of supports 6.5m, conductor dia 1.82cm, weight per unit length of conductor 2.5kg/m, wind pressure $49kg/m^2$ of projected area. Maximum tensile stress of the conductor 4250kg/cm^2. Factor of safety 5. Calculate the allowable sag in meters at the lower support.

4. 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.

5. (a) What is the effect of 3-ϕ induction motor operation on supply power factor?Discuss?
   (b) The load on an installation is 800KW,0.8 lagging which works for 3000 hours per annum. The tariff is Rs 100 per KVA plus 20 paise per KWh. If the power factor is improved to 0.9 lagging by means of loss-free capacitors costing Rs 60 per KVAR, calculate the annual saving effected. Allow 10% per annum for interest and depreciation on capacitors.

6. Which devices are used in a transmission system for reducing the line voltage, when it exceeds the normal level. Explain them with the aid of neat sketches and vector diagrams.

7. (a) What is the importance of base KVA in short circuit calculations?
   (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) Explain the concept of sequence impedances of a 3-ϕ star connected static load whose neutral is grounded through some impedance and draw its sequence impedance networks.

   (b) Draw the positive, negative and zero sequence networks for the system described as follows. The system consists of a 3-ϕ star connected alternator which supplies power to the 3-ϕ star connected synchronous motor through a delta-star step up transformer, a transmission line and a star- delta step down transformer .The neutral points of the machine and transformer windings are un grounded or isolated.

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1. Determine the sending end voltage, current, power factor of a 1-phase,50Hz,76.2kV transmission line delivering a load of 12 MW at 0.8 pf lagging. The line constants are R=25ohms, L=200mH and Capacitance between lines 2.5μF. Also determine the regulation and efficiency of transmission. Use nominalπ method. Draw phasor diagram.

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

3. An overhead transmission line conductor on a hill side is supported between two points separated by a horizontal distance of 400m and at heights of 1150m and 900m above sea level respectively. The weight of the conductor is 1.492kgf/m and the tension is 3935kgf. Determine the vertical clearance between the conductor and a point on the hill side at a height of 970m and a horizontal distance of 175m from the lower support. Assume parabolic configuration.

4. 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.

5. (a) Why is their a phase difference between voltage and current in an ac circuit? Explain the concept of power factor?
   (b) Derive an expression for most economical power factor which may be attained by a consumer?

6. What are the different types of series connected devices used for voltage control in a complete power system network .Explain them with the aid of neat sketches.

7. (a) Explain the harmful effects of short circuit faults on the power system.
   (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) A 3-ϕ alternator is supplying power to the star connected load through a feeder .The alternator per phase impedance is equal to ZS and the load impedances

are ZR , ZY , and ZB in R,Y and B phases respectively . Neglect the feeder impedance . Derive the expressions for phase currents and phase voltages at the load end , when there is a open conductor fault in the R phase .Assume both neutrals are solidly grounded .

(b) A 3-ϕ , 400V , 1MVA alternator has per phase reactance of 3Ω and negligible resistance is supplying power to a star connected load having reactances 10Ω, 20Ω, and 15Ω in R, Y, and B phases respectively . Calculate the phase currents and phase voltages at the load side, when there is a open conductor fault occurs on the R phase of the feeder. Assume both neutrals are solidly grounded .

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

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POWER SYSTEMS-II
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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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 $5x10^{-4}$ omh per Km.

2. Each conductor of a three phase overhead line is suspended from a cross arm of a steel tower by a string of 4 suspension insulators. The voltage across the second unit is 14.2kV and across the third 20kV. Find the voltage between the conductors and the string efficiency.

3. An overhead transmission line has a span of 240m between level supports. Calculate the maximum sag if the conductor weights 727kgf/km and has a breaking strength of 6880kgf. Allow a factor of safety of 2. Neglect wind and ice loading. Derive the formula used.

4. 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.

5. (a) How would you decide which device is to be used for power factor correction for a 3-ϕ system supplying power to a lagging load, explain with an example.?
   (b) What are the advantages and disadvantages of synchronous motor if it is used for power factor improvement.

6. Discuss the need for voltage control in the modern power system and explain them with suitable examples along with neat sketches.

7. (a) Why do you use a single line diagram for power system representation. What are the assumptions that are being made while drawing a single line diagram.
   (b) A transmission line of inductance 0.1H and resistance of 5Ω is connected to a source of V=100sin(ω t+150),f=50HZ at one end and other end is suddenly short circuited at t=0 at the bus-bar end .Write the expression for short circuit current i(t).Find approximately the value of the first current maximum.

8. (a) A 3-ϕ alternator is supplying power to the star connected load through a feeder .The alternator per phase impedance is equal to ZS and the load impedances are ZR , ZY , and ZB in R,Y and B phases respectively . Neglect the feeder impedance . Derive the expressions for phase currents and phase voltages at the load end , when there is a open conductor fault in the R phase .Assume both neutrals are solidly grounded .

(b) A 3-ϕ , 400V , 1MVA alternator has per phase reactance of 3Ω and negligible resistance is supplying power to a star connected load having reactances 10Ω, 20Ω, and 15Ω in R, Y, and B phases respectively . Calculate the phase currents and phase voltages at the load side, when there is a open conductor fault occurs on the R phase of the feeder. Assume both neutrals are solidly grounded .

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

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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 $5x10^{-4}$ omh per Km.

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

3. An overhead transmission line has a span of 240m between level supports. Calculate the maximum sag if the conductor weights 727kgf/km and has a breaking strength of 6880kgf. Allow a factor of safety of 2. Neglect wind and ice loading. Derive the formula used.

4. (a) What are the different types of losses taking place in Cables? Give brief account of them.
   (b) A single-core cable 5km long has an insulation resistance of 0.4 MΩ. The core diameter is 20 mm and the diameter of the cable over the insulation is 50mm. Calculate the resistivity of the insulating material. Derive the formula used.

5. (a) Explain, why a consumer having low power factor is charged at higher rates?
   (b) Explain, why unity power factor is not the most economical power factor?

6. Describe with the aid of neat sketch the construction and working of off load tap changing transformer. Explain how does it control the voltage, when it is connected in a power system network.

7. (a) Explain the harmful effects of short circuit faults on the power system.
   (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) Obtain the expressions for sequence impedances of a 3-ϕ , 3 wire un transposed transmission line. Also draw the sequence impedance networks. Assume that the transmission line is having mutual impedance from phase to phase .
   (b) Obtain the expressions for sequence impedances of a 3-ϕ, 3 wire transposed transmission line. Also draw the sequence impedance networks. Assume that the transmission line is having mutual impedance from phase to phase.

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