

[4]

OR

Find the voltage distribution and string efficiency of a three unit suspension insulator string if the capacitances of the link pins to earth and to the line are respectively 20 percent and 10 percent of the self capacitance of each unit. If a guard ring increases the capacitance to the line of lower link pin to 35 percent of the self capacitance of each unit, find the redistribution of voltage and string efficiency.

5. a) Explain 3-phase, 4-wire system of distributing electrical power.  
b) State the limitations of Kelvin's law.  
c) Draw the layout of an indoor substation and name the accessories.  
d) The daily load cycle of a three-phase 33kV, 10km transmission line is as follows: 2500kVA for 8 hours, 2000kVA for 9 hours and 1500kVA for 7 hours. Determine the most economical cross-section if the cost of line including erection is Rs (7500 + 6000 a) per km where a is the area of each conductor in sq.cm. The rate of interest and depreciation is 8 percent and cost of energy is 15 paise per unit. The line is in use for 250 working days a year. The resistance per km and per sq.cm is 0.173Ω.

OR

Describe sectionalized bus bar system and ring main distribution system with neat sketches.

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Total No. of Questions :5]

[Total No. of Printed Pages :4

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**EX-505**

**B.E. V Semester**

Examination, December 2016

**Power System - I**

*Time : Three Hours*

*Maximum Marks : 70*

- Note:* i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.  
ii) All parts of each questions are to be attempted at one place.  
iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.  
iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Draw a single line diagram of power network. Also give the typical values of the voltages at different levels.  
b) Describe the concept and advantages of distributed generation.  
c) Discuss the problems associated with modern large interconnected power system.  
d) The yearly load duration curve of a power plant is a straight line. The maximum load is 500MW and the minimum load is 400MW. The capacity of the plant is 750MW. Find the  
i) Plant Capacity factor ii) Load factor  
iii) Utilization factor iv) Reserve capacity

OR

A power station supplies the peak loads of 25MW, 20MW and 30MW to three localities. The annual load factor is 0.6pu and diversity of load at the station is 1.65.

Calculate

- i) Maximum demand on the station  
ii) Installed capacity  
iii) Energy supplied in a year.

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2. a) Explain the concept of self GMD and mutual GMD for evaluating inductance of transmission lines.
- b) What are Bundled Conductors? Discuss the advantages of bundled conductors when used for overhead lines?
- c) Derive an expression for the capacitance of a single core cable.
- d) Figure (1) shows a quadruple conductor circuit of a single circuit, three phase, 50Hz line with a horizontal spacing of 20m. Each subconductor of the bundle has a diameter of 40mm and spacing between the sub conductors is 0.5m. Each phase group shares the total current and charge equally and the line is completely transposed. Determine the inductive reactance and capacitive reactance per phase per km of the line.

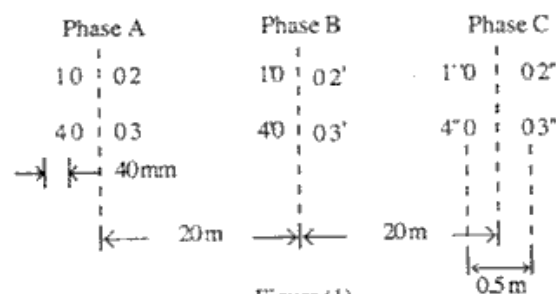


Figure (1)  
OR

The inner and outer dia of a cable are 3cms and 8.5cms. The cable is insulated with two materials having permittivity's of 5 and 3 respectively with corresponding stresses of 38kV/cm and 28kV/cm. Calculate the radial thickness of each insulating layer and the safe working voltage of the cable.

3. a) Describe various systems of power transmission.
- b) What are the different methods for voltage control in a power systems?

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- c) What is a Universal power circle diagram of a transmission line? What information can be obtained from it?
- d) A transmission circuit is represented by a symmetrical  $\pi$  network in which the series impedance is  $120 \angle 60^\circ \Omega$  and each shunt admittance is  $2.5 \times 10^{-3} \angle 90^\circ S$ .

Calculate

- i) The value of the general circuit constants ABCD and
- ii) The characteristic impedance of the circuit.

OR

15000kVA is received at 33kV at 0.85 power factor lagging over an 8km three-phase overhead line. Each line has  $R = 0.29 \Omega$  per km, and  $X = 0.65 \Omega$  per km.

Calculate

- i) The voltage at the sending end
- ii) The power factor at the sending end
- iii) The regulation, and
- iv) The efficiency of the transmission line

4. a) Enumerate the different types of insulators used for overhead transmission lines.
- b) What is a Sag-template? How this is useful for location of towers and stringing of power conductors?
- c) Describe the vibration of power conductors and explain in brief the methods to damp out these vibrations.
- d) A transmission line has a span of 150m between supports, the supports being at the same level. The conductor has a cross-sectional area of  $2 \text{ cm}^2$ . The ultimate strength is  $5000 \text{ kg/cm}^2$ . The specific gravity of the material is 8.9. If the wind pressure is  $1.5 \text{ kg/m}$  length of conductor, calculate the sag at the centre of the conductor if factor of safety is 5.