

CS/B.TECH/EE (NEW)/SEM-5/EE-502/2013-14

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2013

POWER SYSTEMS – I

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following :

10 × 1 = 10

- i) Stranded conductors are used to
- a) reduce transmission loss
 - b) increase mechanical flexibility
 - c) reduce skin effect
 - d) increase stability.

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- ii) In a transmission line having negligible resistance the surge impedance is given by

- a) $\frac{1}{\sqrt{LC}}$
- b) $\sqrt{\frac{L}{C}}$
- c) $\sqrt{\frac{C}{L}}$
- d) \sqrt{LC} .

- iii) The capacitance between any two conductors of a 3-core cable with sheath earthed is 3 μ F. the capacitance per phase will be

- a) 1.5 μ F
- b) 6 μ F
- c) 1 μ F
- d) none of these.

- iv) A three disc string insulator having 50% string efficiency is operated at 66 kV. The voltage across the disc nearest to the conductor is

- a) 40 kV
- b) 45 kV
- c) 50 kV
- d) 44kV.

- v) Use of bundle conductors in EHV transmission system provides

- a) increased line reactance
- b) decreased capacitance
- c) reduced voltage gradient
- d) increased corona loss.

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- vi) The length of a short transmission line is up to about
- a) 50 km b) 120 km
- c) 200 km d) 300 km.
- vii) The volume of copper required for an overhead transmission line is inversely proportional to
- a) current b) voltage
- c) power factor d) both (b) and (c).
- viii) The self GMD method is used to evaluate
- a) inductance
- b) capacitance
- c) both inductance and capacitance
- d) none of these.
- ix) For transmission line which of the following relations is correct ?
- a) $AD - BC = 1$ b) $AC - BD = 1$
- c) $BA - CD = 1$ d) $BC - AD = 1$.
- x) Running cost of a nuclear power plant is about
- a) 20 paise per unit b) 40 paise per unit
- c) 64 paise per unit d) 48 paise per unit.

GROUP - B

(Short Answer Type Questions)

Answer any *three* of the following. $3 \times 5 = 15$

2. What is meant by arcing ground ? How can it be minimized ?
3. A three phase line has conductors 2 cm in diameter spaced equilaterally 1m apart. If the dielectric strength of air is 30 kV (peak)/cm, find the disruptive critical voltage for the line. Take air density correction factor $\delta = 0.952$ and irregularity factor $md = 0.9$.
4. Discuss the effect of wind and ice on sag.
5. Prove that $g_{\max}/g_{\min} = D/d$ in a single core cable.
6. Explain with the help of phasor diagram, Ferranti effect.

GROUP - C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Determine the generalized constants of a medium transmission line by nominal T method. 7

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- b) A 3-phase transmission line, 160 km long, has the following constants :

Resistance /phase/km = 0.2Ω

Reactance/phase/km = 0.3127Ω

Shunt admittance/phase/km = $1.875 \times 10^{-6} \text{ s}$

Determine the sending end voltage and current by rigorous method when the line is delivering a load of 25 MVA at 0.8 pf. lagging. The receiving end voltage is kept constant at 110kV. 8

- 8 a) Draw a general layout of modern thermal power plant and explain the working of different circuits and components. 6
- b) State and explain what do you mean by string efficiency. 3
- c) A string of 6 suspension insulators is to be graded to obtain uniform distribution of voltage across the string. If pin to earth capacitances are all equal to C and mutual capacitance of the top insulator is $20C$, find the mutual capacitance of each unit in terms of C. 6

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9. a) What is meant by the term "tariff" ? 2
- b) Explain the following :
- i) Two-part tariff
- ii) Maximum demand tariff
- iii) Availability based tariff. 2 + 2 + 2
- c) A consumer has a maximum demand of 250 kW at 45% load factor. If the tariff is Rs. 100 per kW of maximum demand plus 10 paise per kWh, find the overall cost per kWh. 7
10. a) Derive the expression for the inductance of a 3-phase line. 6
- b) A single core cable for use on 11 kV, 50 Hz system has conductor area of 0.645 cm^2 and the internal diameter of sheath is 2.18cm. the permittivity of the dielectric used in the cable is 3.5. find the minimum and maximum stress in the cable. Find also the capacitance and charging current of the cable. 9

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11. Write short notes on any *three* of the following : 3×5

- a) Choice of voltage for transmission line
 - b) Proximity effect
 - c) Back flashover
 - d) Step and touch potential
 - e) Load curve and information obtained from load curves.
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