Code : 031404

B.Tech. 4th Semester Exam., 2015

POWER SYSTEM—I

Time : 3 hours *Full Marks* : 70

Instructions :

(i) All questions carry equal marks.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

1. Choose the correct answer (any *seven*) :

(a) For a medium length transmission line, A is

(i) equal to B

(ii) equal to C

(iii) equal to D

(iv) not equal to any of the above

(b) To increase the transmission capability of a high-voltage longline

(i) the resistance can be increased

(ii) the resistance can be decreased

(iii) the series reactance can be reduced

(iv) the shunt admittance can be reduced

(c) The surge impedance of 50-mile long underground cable is 50 ohms. For a length of 25 miles the impedance will be

(i) 26 ohms

(ii) 50 ohms

(iii) 100 ohms

(iv) 12·5 ohms

(v) None of the above

(d) In a transmission system, the weight of copper used is proportional to

(i) E^2

(ii) E

(iii) $1/E^2$

(iv) $1/E$

(v) None of the above

(e) Stringing chart is useful for

(i) finding the sag in the conductor

(ii) the design of tower

(iii) the design of insulator string

(iv) finding the distance between towers

(f) The regulation of a line at full-load 0·8 of lagging is 12%. The regulation at full-load 0·8 p.f. leading can be

(i) 24%

(ii) 18%

(iii) 12%

(iv) 4%

(g) The inductance of a line is minimum when

(i) GMD is high

(ii) GMR is high

(iii) Both GMD and GMR are high

(iv) GMD is low and GMR is high

(h) Which distribution system is more reliable?

(i) Ring main system

(ii) Tree system

(iii) Radial system

(iv) All are equally reliable

(i) In a 3-core cable, the capacitance between 2 conductors (with sheath earthed) is 3 μF. The capacitance/phase is

(i) 1·5 μF

(ii) 3 μF

(iii) 6 μF

(iv) 12 μF

(j) For a transmission line with resistance $R\ \Omega$, reactance $X\ \Omega$ and negligible capacitance, the parameter A is

(i) 0

(ii) 1

(iii) $R + jX$

(iv) $(R^2 + X^2)^{1/2}$

2. Describe the various systems of power transmission and compare the following as regard to the amount of copper used for the same distance, the same power transfer, the same maximum voltage to ground and the same power loss :

(a) 3-phase, 3-wire AC

(b) 3-wire DC

(c) 1-phase, 2-wire AC

5. *(a)* Find the inductance per phase of 3-ϕ overhead transmission line using 2 cm diameter conductors when these are placed at the corners of equilateral triangle of sides 4 meters. Also do the derivation needful.

(b) The three conductors of a 3-ϕ transmission line are arranged in a horizontal plane and are 4 meters apart. The diameter of each conductor is 2·5 cm. Determine the inductance per km of the each conductor (line to neutral). Assume balanced load and *R*, *Y*, *B* phase sequence. Determine the average inductance per phase for regularly transposed line.

6. *(a)* Discuss the effect of wind and ice on sag.

(b) The following data refers to a transmission line supported on level supports :

Span length = 220 meters

Hard drawn copper conductor :

X-sectional area = 120 mm^2;

37/2·11 mm; W_c = 1·2 kg/m

Ultimate tensile stress = 42·2 kg/mm^2

Factor of safety = 4

Wind pressure = 55 kg/m^2

Thickness of ice coating = 12 mm

Density of ice = 913 kg/m^3

Find the vertical sag.

3. *(a)* State Kelvin's law and explain why in practice the law is usually not strictly observed.

(b) The following data relate to a 2-wire feeder :

Current carried through out the year = 220 A

The portion of the capital cost which is proportional to X-sectional area = ₹ 6 per kg of Cu conductor

Cost of energy = 6 P per kWh

Interest and depreciation charges = 10% PA

Density of copper = 8·93 g/cm^3

Specific resistance of copper = 1·8 $\mu\Omega$-cm

Find the most economical X-section of the conductor.

4. A 1·5 km long single-phase 2-wire feeder supplies the loads as under :

60 A at 0·8 p.f. (lagging), 600 m from the fed point

40 A at 0·85 p.f. (lagging), 1200 m from the fed point

50 A at 0·88 p.f. (lagging), 1500 m from the fed point

The resistance and reactance of the feeder per km length (go and return) are 0·12 Ω and 0·2 Ω respectively. If the voltage at the far end is to be maintained at 220 V, calculate the voltage of the sending end, and its phase angle with respect to the receiving end voltage.