D 42174 (Pages : 2) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION DECEMBER 2007

EE 04 504—POWER SYSTEM—I

(2004 Admissions)

Time : Three Hours *Answer* all *questions.* Maximum : 100 marks

I. a) What are the advantages and disadvantages of non-conventional energy sources as compared to conventional energy sources?

b) Write short notes on the economics of power factor improvement.

c) Explain how to determine the economic transmission voltage?

d) A single-core lead sheathed cable is graded by using three dielectrics of relative permittivity 5, 4, and 3 respectively. The conductor diameter is 2 c.m. and overall diameter is 8 c.m. If the three dielectrics are worked at the same maximum stress of 40 kV/c.m., find the safe working voltage of the cable. What will be the value of safe working voltage for an ungraded cable, assuming the same conductor and overall diameter and the maximum dielectric stress?

e) A transmission line has a span of 275 m between level supports. The conductor has an effective diameter of 1.96 c.m. and weighs 0.865 kg/m. Its ultimate strength is 8600 kg. If the conductor has ice coating of radial thickness 1.27 c.m. and is subjected to a wind pressure of 3.9 gm/cm^2 pf projected area, calculate the sag for a safety factor of 2. Weight of 1 c.c. of ice is 0.91 gm.

f) Derive an expression for the voltage drop for a uniformly loaded distributor fed at one end.

g) A 132 kV, 50 Hz, three-phase transmission line delivers a load of 50 MW at 0.8 p.f. lagging at the receiving end. The generalized constants of the transmission line are $A = D = 0.95\angle 1.4^0$; $B = 96\angle 78^0$; and $C = 0.0015\angle 90^0$. Find the regulation of the line and charging current.

h) Derive an expression for the loop inductance of a single phase line.

(8 × 5 = 40 marks)

II. a) With a neat schematic diagram of a nuclear power station, explain its operation.

OR

b) Derive an expression for the most economical value of power factor which may be attained by a consumer. (7)

A factory has an average demand of 320 kW and an annual load factor of 50%. The power factor is 0.8 lagging. The tariff is Rs. 80 per annum per kVA maximum demand plus 5 paise per kWh. If the losss free capacitors costing Rs. 100 per kVAR are to be initialized, find the value of power factor at which maximum saving will result. The interest and depreciation together amount to 12%. Also determine the annual saving effected by improving the power factor to this value. (8)

III. a) ACSR conductors are preferred for transmission and distribution. Give reasons. (5)

A string of eight suspension insulators is to be fitted with a grading ring. If the pin to earth capacitances are all equal to C, find the values of the line to pin capacitances that would give a uniform voltage distribution over the ring. (10)

OR

Turn over

b) Derive an expression for the insulation resistance of a single core cable. (7)
A 66 kV single core lead sheathed cable is graded by using two dielectrics of relative permittivity 5 and 3 respectively; thickness of each ring being 1 c.m. The core diameter is 2 c.m. Determine the maximum stress in the two dielectrics. (8)

IV. a) Derive an expression for the voltage drop of a uniformly loaded distributor fed at one end.
What are the advantages of a doubly fed distributor over singly fed distributor.?

OR

b) Deduce an approximate expression for sag in overhead lines when
i) supports are at equal levels
ii) supports are at unequal levels.

V. a) What are bundled conductors? Discuss the advantages of bundled conductors when used for overhead lines.
Determine the inductance of the double circuit line shown in Fig. 1. The self GMD of the conductor is 0.0069 m.

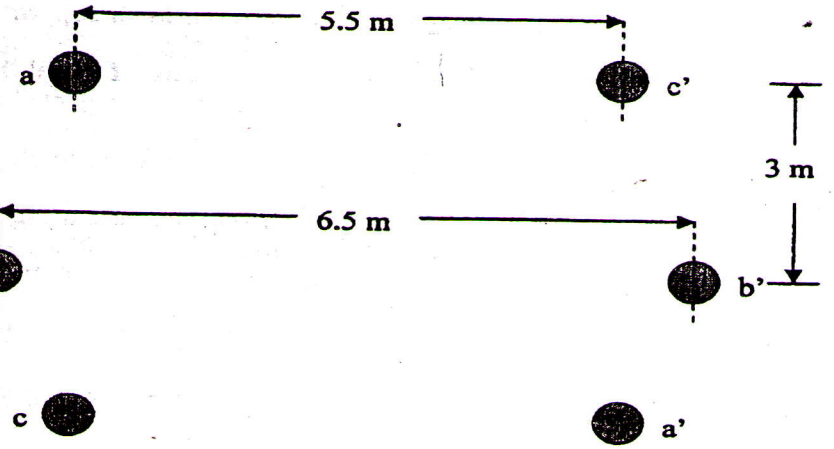

Fig. 1

OR

b) A 100 km long three-phase, 50 Hz transmission line has the following line constants:
Resistance per phase per km = 0.1 Ω
Reactance per phase per km = 0.5 Ω
Suspectance per phase per km = 10×10^{-6} S
If the line supplies load of 20 MW at 0.9 p.f. lagging at 66 kV at the receiving end, calculate by nominal π method
i) sending end power factor and ii) transmission efficiency

[4 × 15 = 60 marks]