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Name .....

Reg. No. .....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2013

EE 09 502—ELECTRICAL POWER GENERATION, TRANSMISSION AND DISTRIBUTION

Time : Three Hours Maximum : 70 Marks

Part A

All *questions are* **compulsory.**

1. A generating station has a connected load of 43 MW and a maximum demand of 20 MW ; the units generated being 61. 5×10^6 per annum. Calculate the demand factor and load factor.
2. An overhead line has a span of 250 m. The tension in the line is 1500 kg while the conductor weighs 750 kg per 1000 m. Calculate the maximum sag in the conductor.
3. Define string efficiency.
4. The conductors of three phase, 3 wire system are transposed and are arranged in horizontal plane, such that $D_{12} = D_{31} = 1.8$ m ; $D_{23} = 3.6$ m. If the diameter of each conductor is 2.2 cm, calculate the inductance per phase per km length of the line.
5. State the factors which govern the capacitance of a transmission line.

(5 × 2 = 10 marks)

Part B

Answer any *four* questions :

6. Enumerate the essential elements of hydroelectric power plant.
7. Explain the working of a geothermal plant.
8. Give brief description of ACSR conductor.
9. Explain the use of guard rings and arcing horns on suspension insulators.
10. Compare the 3-wire and 2 wire systems of d.c. distribution in respect of weights of copper conductors, all other conditions being the same.
11. Show that when the effect of earth is considered, the capacitance of a two-wire transmission line is given by

$$C_{ab} = \frac{\pi\varepsilon}{\ln\left[\frac{D}{r\sqrt{1+\frac{D^2}{4h^2}}}\right]} \text{ F/m line-to-line}$$

Turn over

where, ε = permittivity of the medium

D = spacing between conductors

h = height of conductor above ground, and

r = radius of each conductor.

(4 × 5 = 20 marks)

Part C

12. With a neat sketch, explain the layout of a diesel power plant.

Or

13. Write short notes on :

    (a) Economics of power factor improvement.

    (b) Capacity of phase advancing plant.

14. (a) Derive an expression for sag in overhead line conductor supported by the towers situated at different levels.

    (b) A transmission line has a span of 240 m. Find the weight of the conductor per metre length if the sag, ultimate tensile strength and factor of safety are 1.6 m, 5200 kg and 2 respectively.

Or

15. (a) Explain the factors that affect corona.

    (b) A three phase, 220 kV, 50 Hz transmission line consists of 30 mm diameter conductor spaced 2.5 m apart in the form of an equilateral triangle. If the temperature is 38° C and atmospheric pressure is 76 cm, calculate the corona loss per km of the line. Assume the irregularity factor as 0.83.

16. A 2 wire d.c. distributor ABCDEA in the form of a ring main is fed at point A at 230 V and is loaded as 20 A at B ; 40 A at C ; 60 A at D ; and 20 A at E. The resistance of various sections (go and return) are : AB = 0.1 Ω ; BC = 0.05 Ω ; CD = 0.01 Ω ; DE = 0.025 Ω and EA = 0.075 Ω. Draw the distributor for the problem. Find the point of minimum potential and the currents in each section of distributor.

Or

17. Explain briefly the following methods of grading the cables :

    (a) Capacitance grading.

    (b) Intersheath grading.

18. (a) Derive an expression for the loop inductance of a single phase, two wire (solid) system from the fundamentals.

(b) A 3 phase, 132 kV, 50 Hz overhead transmission line has steel cored aluminum conductors of equivalent copper area of 1.5 cm^2 and effective diameter of 39.2 mm spaced equilaterally 8m apart. Calculate the line constants per km length of the line. The resistivity of the copper is 1.73 $\mu\Omega$ cm.

Or

19. The following data refers to a 3 phase overhead transmission line :

Voltage between lines = 220 kV ; total series impedance per phase = $20\acute{0} \angle 80^\circ\ \Omega$; total shunt admittance per phase = $0.0013 \angle 90^\circ$ S ; load delivered = 100 MW at 0.8 pf lagging. Use rigorous method to determine the sending end voltage and sending end current.

(4 × 10 = 40 marks)