D 51613 (Pages 3) Name.....

Reg. No.....

FIFTH SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, DECEMBER 2008

EE 04 504—POWER SYSTEMS—I

(2004 admissions)

Time : Three Hours Maximum : 100 Marks

1. (a) The weekly discharge of a typical hydroelectric plant is as under :

Day	Sun	Mon	Tue	Wed	Thu	Fri	Sat
Discharge (M^3/sec)	500	520	850	800	875	900	546

The plant has an effective head of 15 m and an overall efficiency of 85%. If the plant operates on 40% load factor, estimate (i) the average daily discharge (ii) pondage required and (iii) installed capacity of proposed plant.

(b) Explain how to improve the diversity factor of a power station.

(c) A certain three-phase equilateral transmission line has a total corona loss of 53 kV at 106 kV and a loss of 98 kW at 110 kV. What is the disruptive critical voltage ? What is the Corona loss at 113 kV ?

(d) The capacitances of a three-phase belted cable are 12.6 μF between the three cores branched together and the lead sheath and 7.4 μF between one core and the other two connected to sheath. Find the charging current drawn by the cable when connected to 66kV, 50Hz supply.

(e) A 2 wire d.c. ring distributor is 300 m long and is fed at 240 V at point A. At point B, 150m from A, a load of 120 A is taken and at C, 100m in the opposite direction, a load of 80 A is taken. If the resistance per 100 m of of single conductor is 0.03 Ω, find (i) current in each section of distributor, and (ii) voltages at points B and C.

(f) The towers of height 30 m and 90 m respectively support a transmission line conductor at water crossing. The horizontal distance between towers is 500m. If the tension in the conductor is 1600 kg, find the minimum clearance of the conductor and water and clearance mid-way between the supports. Weight of conductor is 1.5kg/m. Bases of towers can be considered to be at water level.

(g) Derive an expression for the capacitance of a single-phase over head transmission line.

(h) Evaluate the generalized circuit constants for short transmission line.

Turn over

II. (a) With a neat schematic diagram of a hydroelectric plant, explain the functions of various components.

Or

(b) Discuss briefly various methods of determining the depreciation of the equipments.

III. (a) (i) Discuss the various conductor materials used for overhead lines. What are their relative advantages and disadvantages ?

(7 marks)

(ii) A string of eight suspension insulators is to be graded to obtain uniform distribution of voltage across the string. If the capacitance of the top unit is 10 times the capacitance to ground of each unit, determine the capacitance of the remaining seven units.

(8 marks)

Or

(b) Explain the following methods of cable grading : —

(i) Capacitance grading.

(ii) Intersheath grading.

IV. (a) A single-phase distributor one km long has resistance and reactance per conductor of 0.1 Ω and 0.15 Ω respectively. At the far end, the voltage $V_B = 200$ V and the current is 100 A at 0.8 p.f. lagging . At the midpoint M of the distributor, a current of 100 A is tapped at 0.6 p.g. lagging with reference to the voltage V_M at the mid point. Calculate.

(i) Voltage at mid-point.

(ii) Sending end voltage V_A.

(iii) Phase angle between V_A and V_B.

Or

(b) (i) Derive the expressions for sag and tension when the supports are at unequal levels.

(8 marks)

(ii) An overhead line has the following data : —

Span length 160 meters, conductor diameter 0.9 c.m. weight per unit length of the conductor 0.65 kg/m, Ultimate stress 4250 kg/cm^2, wind pressure 40 kg/m^2 of projected area. Factor of safety 5. Calculate the sag.

(7 marks)

V. (a) Explain the concept of self GMD and mutual GMD for evaluating inductance of transmission lines.

Or

(b) A three-phase, 50Hz transmission line 100 km long delivers 20 MW at 0.9 p.f. lagging and 110 kV. The resistance and reactance of the line per phase per km are $0.2\,\Omega$ and $0.4\,\Omega$ respectively, while capacitance admittance is 2.5×10^{-6} siemen/km/phase. Calculate (i) the current and voltage at the sending end and (ii) efficiency of transmission. Use nominal T method.