

Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech

Branch : EEE

Semester : 4

Title of the Course : Power Systems

Course Code : EEL 253

Time: 3hrs

Maximum Marks: 50

Section A

Attempt all question

(10×1 = 10)

- Q. [1] Define plant use factor.
- Q. [2] State the advantages of interconnected grid system.
- Q. [3] The higher the load factor of a power station, the.....is the cost per unit generated. (more, lesser)
- Q. [4] The value of diversity factor is.....than one.
- Q. [5] The lesser the diversity factor, theis the cost of generation of power. (greater, lesser).
- Q. [6] Most of the sub-stations in the power system change.....of electric supply. (voltage level, current level).
- Q. [7] The discs of the strain insulators are used in plane. (vertical, horizontal)
- Q. [8] If the conductor size is increased, the corona effect is..... (increased, decreased)
- Q. [9] The longer the cross arm, the the string efficiency. (greater, lesser)
- Q. [10] Corona effect is pronounced in stormy weather as compared to fair weather. (more, less)

Section B

Attempt any four

(4×5 = 20)

- Q. [1] A transmission line has an inductance of 16 mH and a capacitance of 0.1 microfarad is connected to a cable which is having an inductance of 1.6 H and a capacitance of 0.1 microfarad. If an incident voltage of 40 kV is transmitted from transmission line towards the cable. Find, (i) Transmitted voltage wave in cable (ii) Transmitted current wave in cable (iii) Reflected voltage and current waves, and (iv) Incident current wave.

- Q. [2]** Discuss the various conductor materials used for overhead lines. What are their relative advantages and disadvantages?
- Q. [3]** Two single-phase ideal voltage sources are connected by a line of impedance of $0.7 + j2.4 \text{ ohm}$. $V_1 = 500\angle 16.26^\circ \text{ V}$ and $V_2 = 585\angle 0^\circ \text{ V}$. Find the complex power for each machine and determine whether they are delivering or receiving real and reactive power. Also, find the real and the reactive power loss in the line.
- Q. [4]** Using rigorous method, derive expressions for sending end voltage and current for a long transmission line.
- Q. [5]** Deduce an expression for voltage regulation of a short transmission line, giving the vector diagram.

Section C

Attempt any two

(2×10 = 20)

- Q. [1]** Explain the variation of current and voltage on an overhead line when one end of the line is (i) short-circuited, and (ii) open-circuited and at the other end a source of constant e.m.f. V is switched in.
- Q. [2]** The fuel cost function for three thermal plants in \$/h are given by

$$C_1 = 500 + 5.3P_1 + 0.004P_1^2$$

$$C_2 = 400 + 5.5P_2 + 0.006P_2^2$$

$$C_3 = 200 + 5.8P_3 + 0.009P_3^2$$

where P_1 , P_2 and P_3 are in MW. Find the optimal dispatch and the total cost in \$/h for the plants, when the total load is 800 MW with the following generator limits (in MW):

$$350 \leq P_1 \leq 450$$

$$210 \leq P_2 \leq 270$$

$$50 \leq P_3 \leq 210$$

- Q. [3]** Three loads are connected in parallel across a 12.47 kV three-phase supply.

Load 1: Inductive load, 60 kW and 660 kVAR.

Load 2: Capacitive load, 240 kW at 0.8 power factor.

Load 3: Resistive load of 60 kW.

(a) Find the total complex power, power factor, and the supply current.

(b) A Y-connected capacitor bank is connected in parallel with the loads. Find the total kVAR and the capacitance per phase in microfarad to improve the overall power factor to 0.8 lagging. What is the new line current?