Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	**: EEE**	**Semester**	**: 4th**
Title of the Course	**: Power Systems**	**Course Code**	**: EEL 253**

Time: 3 Hours **Maximum Marks: 50**

Note : 1. Do not write anything on the question paper except Roll number

2. Assume any data suitably if found missing

Section A: Answer all 10 questions. Each question carries 01 mark. [10×1=10]

A1. Load curve is a graph between ..... on x-axis and ..... on y-axis.

A2. Demand factor is the ratio of ..... to .....

A3. The conductor connecting consumer's terminals to the distributor is called .....

A4. Transmitted power remaining the same, if the supply voltage of a two-wire distributor is doubled, saving in copper will be .....

A5. Pin type insulators are generally not used for voltages exceeding ..... kV.

A6. Any two conductors separated by an insulating medium constitute a .....

A7. In short transmission line the effect of ..... is neglected.

A8. The square root of the ratio of line impedance and shunt admittance is called..... Impedance.

A9. Over excited synchronous phase modifier draws ..... current.

A10. Breakdown strength of air at NTP is .....

Section B: Answer any 4 questions. Each question carries 5 marks. [4×5=20]

B1. A consumer has the following connected loads: 10 lamps of 60 W each and two heaters of 1000 W each. His maximum demand is 1500 W. On the average he uses 8 lamps 5 hours a day and each heater for 3 hours a day. Find his average load, monthly energy consumption and load factor.

B2. An all aluminum conductor is composed of seven identical strands, each having a radius 'r'. Find the self GMD of the conductor.

B3. A 3 unit insulator string is fitted with a guard ring. The capacitance of the link pins to metal work and guard ring can be assumed to be 15% and 5% of the capacitance of each unit. Determine the voltage distribution and string efficiency.

B4. A 15 **km** long 3-phase overhead line delivers 5 **MW** at 11 **kV** at 0.8 lagging power factor. Line loss is 12% of power delivered. Line inductance is 1.1 **mH / km / phase**. Find sending end voltage and voltage regulation.

B5. A certain 3-phase equilateral transmission line has a total corona loss of *53 kW* at *106 kV* and a loss of *98 kW* at *110.9 kV*. What is the disruptive critical voltage? What is the corona loss at *113 kV*?

Section C: Answer any 2 questions. Each question carries 10 marks. **[2×10=20]**

C1. The cost per km of each of the copper conductor of a section $a\,cm^2$ for a transmission line is $Rs.\,(2800a+1300)$. The load factor of the load current is 80% and the load factor of the losses is 65%. The rate of interest and depreciation is 10% and the cost of energy is 50 *paisa per kWh*. Find the most economical current density of the transmission line by the use of Kelvin's law. Given $\rho=1.78\times10^{-8}\,\Omega-m$.

C2. A single core lead covered cable is to be designed for $66\,kV$ to earth. Its conductor radius is $0.5\,cm$ and its three insulating materials A, B and C have relative permittivity's of 4, 2.5 and 4 with maximum permissible stresses of 50, 30 and 40 kV/cm respectively. Determine the minimum internal diameter of lead sheath.

C3. A $100\,km, 50\,Hz, 3-\phi$ line with $\mathbf{r}=0.03\,\Omega, \mathbf{x}=0.10\,\Omega, \mathbf{c}=0.01\,\mu\mathbf{F}$ **per km** of line length has a load of 2 **MW** at 0.8 power factor lag at the receiving end. The receiving end is maintained at 11 **kV** by connecting at receiving end a bank of static capacitors rated at 1 **MVAR** at 11 **kV**. Calculate the voltage, current, power factor and power angle at the sending end of the line using nominal - π method.