Roll No.:.....

National Institute of Technology, Delhi

Name of the Examination: B. Tech.

Branch	**: EEE**	**Semester**	**: 4th**
Title of the Course	**: Power Systems-I**	**Course Code**	**: EE 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 multiple choice questions. Each question carries 01 mark. [10×1=10]

A1. ..... curve gives the number of hours for which a particular load lasts during the day.

A2. Diversity 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. With the same maximum voltage between conductors, the ratio of copper volume required in 3-phase 3 wire system and 1-phase 2 wire system is .....

A6. In overhead lines we generally use ..... conductors

A7. Pin type insulators are generally not used for voltages exceeding ..... kV.

A8. The increase in resistance due to non-uniform distribution of current in a conductor is known as ..... effect.

A9. Any two conductors separated by an insulating medium constitute a .....

A10. 120 km long transmission line is considered to be ..... line.

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

B1. Explain how ocean thermal energy can be used for producing electrical power? What are the difficulties in extracting ocean thermal energy?

B2. Find the inductive reactance in ohms per kilometer at $50\,Hz$ of a three-phase bundled conductor line with two conductors per phase as shown in Fig. 2. All conductors are ACSR with radii of 1.725 cm.

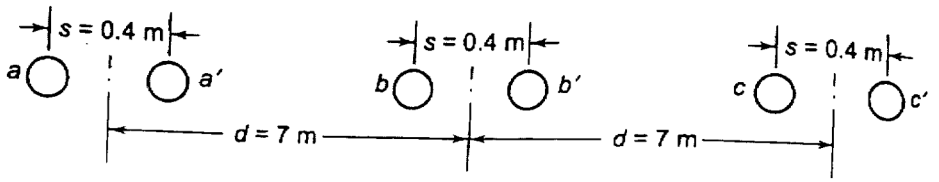

Figure. 2

B3. A suspension string has 3 units. Each unit can withstand a maximum voltage of $11\,kV$. The capacitance of each joint and metal work is 20% of the capacitance of each disk. Find (a) maximum line voltage for which the string can be used (b) string efficiency.

B4. A single core cable for $66\,kV$ 3-phase system has a conductor of $2\,cm$ diameter and a sheath of inside diameter $5.3\,cm$. It is required to have 2 intersheaths so that stress varies between the same maximum and minimum values in the 3 layers of dielectric. Find the positions of intersheaths, maximum and minimum stress and voltages on intersheaths.

B5. A $132\,\mathbf{kV}$ line with $1.956\,\mathbf{cm}$ diameter conductors is built so that corona takes place if the line voltage exceeds $210\,\mathbf{kV}$ (r.m.s). If the value of potential gradient at which ionization occurs can be taken as $30\,\mathbf{kV/cm}$ (peak), find the spacing between the conductors.

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

C1. Find (i) the maximum demand (ii) daily energy consumption (iii) Load factor of a power supply system having the following loads:

Type of load	Maximum demand in kW	Load factor (%)	Diversity factor	Overall diversity factor
Domestic	2000	25	1.2	1.30
Commercial	3000	30	1.10	
Industrial	8000	70	1.25	

What are the connected loads of each category if the demand factors for domestic, commercial and industrial loads are 50, 60 and 80 percent respectively?

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C2. A single core cable for $66\,kV$ 3-phase system has a conductor of $2\,cm$ diameter and a sheath of inside diameter $5.3\,cm$. It is required to have 2 intersheaths so that stress varies between the same maximum and minimum values in the 3 layers of dielectric. Find the positions of intersheaths, maximum and minimum stress and voltages on intersheaths. Also find the maximum and minimum stress if the intersheaths are not used.

C3. 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 $\rho=1.78\times10^{-8}\,\Omega-m$.