Ref No. Ex/PE/T/315/2017(S)

B. POWER ENGINEERING EXAMINATION -2017

(3rd Year – 1st Semester, Supplementary)

SUBJECT – Power Transfer Systems

Time: Three hours | Full Marks: 100

Answer any *five* questions

Assume suitable values for missing data, if any

All parts of a question to be answered at one place

No. of Question		Marks
Q. 1. (a)	Define and explain the following with suitable examples: (i) Diversity Factor (ii) Plant factor (iii)Load Factor	2+2+2
(b)	Determine the maximum value of a load i.e. maximum demand which consumes 600 kWh per day at a load factor 0.45. If the consumer increases the load factor to 0.65 without increasing the maximum demand, determine the consumption of energy in kWh.	3+3
(c)	Explain dielectric loss of a cable. What are the main causes for this loss?	2+2
(d)	A consumer has annual consumption of 200000 kWh at a load factor of 40%. The tariff is Rs. 750 per kW of maximum demand per year plus Rs. 1.15 per kWh. Determine the saving in energy cost if the load factor is improved to 60%.	4
2. (a)	Discuss Kelvin's law and hence derive the expression for the most economic current density for a conductor.	10
(b)	The cost of a three-phase overhead line is Rs. (150a + 10000) per km length where a is the cross section of the conductor in sq. mm. The rate of interest and depreciation per annum is 10% of capital cost. If the load is supplied for 60% of the year, estimate the most economic current density of the conductor. The cost of energy is Rs. 0.15 per kWh and resistivity is 1.8 $\mu\Omega$-cm.	10
3. (a)	Describe the methods of the measurements of capacitances in a three-core belted cable.	10

(b)	Determine the overall diameter of a single-core cable and its most economic diameter when working on a three-phase 275 kV system. The maximum permissible stress in the dielectric is not to exceed 15 kV/mm.	10
4. (a)	Derive an expression for the total induction of a single-phase cable in terms of conductor diameter.	8
(b)	Define and explain string efficiency. What is the necessity of having high string efficiency? How can it be achieved? A string of eight suspension insulators is to be fitted with a grading ring. If the pin-to-earth capacitances are all equal to *C*, find the values of line-to-pin capacitances that would give a uniform voltage distribution over the string.	12
5. (a)	Draw and explain the phasor diagram for a medium transmission line assuming nominal T model.	10
(b)	A three-phase overhead transmission line 100 long has the following constants per km: resistance and reactance per phase are 0.15 Ω and 0.4 Ω respectively, line to neutral admittance due to capacitance is 0.5 x 10^{-6} S. Find the sending end voltage when the load delivered is 30 MVA, power factor 0.8 lagging, at 66 kV.	10
6. (a)	A 5 kVA, 400/200 V, 50 Hz single phase transformer has primary and secondary reactance each of 2.5 Ω. Determine the equivalent reactance in per unit referred to (i) primary side (ii) secondary side.	8
(b)	A 100 MVA, 33 kV three-phase generator has a reactance of 15%. The generator is connected to three motors through a transmission line and two transformers T1 and T_2 at the generator end and motor end respectively. Motors are rated inputs of 40 MVA, 30 MVA and 20 MVA at 30 kV with reactance 20% each. Draw the per unit reactance diagram showing the per unit values for each component on the diagram. Data for the transformers are given below. The transformer line has a reactance of 60 ohm. T_1 : 110 MVA , delta-star, 32/110 kV, X = 8% T_2 : 110 MVA , star-delta, 110/32 kV, X = 8%	12
7. (a)	What are the problems associated with HVDC transmission?	

	How HVDC interconnections are technically superior to the HVAC transmission?	12
(b)	Explain why series compensation leads to improvement in system stability Compare the performance of series and shunt capacitors in a power system.	8
8.	Write technical notes on (i) Converter station of HVDC transmission String (ii) XLPE cable (iii) Ferranti effect (iv) Intersheath grading of cables.	4x5