Ref. No.: Ex/PE/T/325/2017 (Old)

B. POWER ENGINEERING EXAMINATION -2017 (Old)

(3^{rd} Year – 2^{nd} Semester)

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) Demand Factor (ii) Diversity Factor (iii)Load factor	2+2+2
(b)	A power station supplies peak loads of 25 MW, 20 MW and 30 MW to three localities. The annual load factor is 0.6 and diversity of the load at the station is 1.65. Determine (i) the maximum demand at the station (ii) installed capacity and (iii) the energy supplied in a year.	2+2+2
(c)	What are the main .causes of electrical failure of line insulators? Hence explain the terms puncture and flashover in line insulators.	4
(d)	An industrial consumer has a maximum demand of 100 kW. Two alternative tariffs are available: (i) A fixed charge of Rs. 5000 per kW of maximum demand per year plus a running charge of Rs.6.20 per kWh of energy. (ii) A flat rate of Rs. 7.50 per kWh of energy. Which tariff is economical if the factory runs for 3600 hours per year with a load factor of 0.8?	4
2. (a)	Explain Kelvin's economy law. What are the limitations of Kelvin's economy law and hence discuss Modified Kelvin's law. Illustrate them with the help of graphical representation.	10
(b)	An 11 kV, 3-core cable is to supply a factory which works 48 hours a week with a load of 500 kW at 0.9 power factor lagging. Capital cost of cable per core when laid is Rs ($40a + 250$) per km where a is the cross section of the conductor in sq. mm. The interest and depreciation charges are 14% of the capital cost and energy cost is	

	16 paise per kWh. Calculate the most economical cross section of the conductor. Assume the resistivity of copper as $1.724 \times 10^{-8}\ \Omega$-m.	10
3. (a)	Describe the construction of three-core belted cable. What are the defects/limitations of belted cable and hence describe screened cable.	10
(b)	The capacitance of a 3-core lead sheathed belted cable of 1 km length are measured and found to be as follows: (i) Between one conductor and the other two conductors connected to the sheath, 4.8 μF. (ii) Between three cores bunched together and the sheath, 7.2 μF. Calculate the capacitance to neutral and the total charging kVA when the cable is connected to an 11 kV, 50 Hz three-phase supply.	10
4. (a)	Explain why voltage across the insulators of a simple insulator string is not equal. Also, describe practical methods to improve voltage distribution.	10
(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.	10
5. (a)	Derive an expression for the capacitance of a symmetrical three phase line.	10
(b)	A single circuit three phase, 50 Hz transmission line 10 km long has conductors 30 mm in diameter with the spacing as follows: A-B = 2 m, B-C = 3m, C-A = 5 m. Assuming adequate transposition and neglecting the effect of flux linkages within the conductors, determine from the first principle, the effective inductive reactance per phase per km.	10
6. (a)	Draw and explain the phasor diagram for transmission line assuming that half the line capacitance is concentrated at each end of the line.	8
(b)	A three phase line, 10 km long delivers 5 MW at 11 KV, 50 Hz, 0.8 power factor lagging. The power loss is 10% of the power delivered. The line conductors are situated at the corners of an equilateral	

	triangle of 2 m side. Calculate the voltage and power factor at the receiving end. Assume the resistivity of copper as 1.724 x 10^{-8} Ω-m.	12
7. (a)	What are the problems associated with HVDC transmission? How HVDC interconnections are technically superior to the HVAC transmission?	10
(b)	Explain why series compensation leads to improvement in system stability Compare the performance of series and shunt capacitors in a power system.	10
8.	Write technical notes on (i) Converter station of HVDC transmission (ii) Ferranti effect (iii) Use of synchronous phase modifier (SPM) for reactive power and voltage control. (iv) XLPE cable	4x5