

**NATIONAL INSTITUTE OF TECHNOLOGY DURGAPUR****Even Semester End-term Examination, 2021-22**

Course Code: EEO440

Full Marks: 30

**Course Name:** FUNDAMENTALS OF POWER SYSTEMS

Time: 90 Minutes

Question Paper No.: NITDGP/EEO440/

Date of Exam: 29-04-2022

Instructions: Answer One question from Section A and Two questions from Section B.

Materials to be supplied: Graph paper shall be supplied, if required.

**Section A**

Q. No.	Question	Marks	Mapped CO
1	(a) Write full form of EHV and UHV and the corresponding voltage values. (b) Find the expression of capacitance of a single phase line. (c) A 220-kV, 50 hz, three-phase transmission line is 80 km long. The line has a per phase series impedance of $z=0.125+j0.4375$ Ohm per km. The shunt capacitance is negligible. Find the voltage and power at the sending end and the voltage regulation and efficiency when the line is supplying a three-phase load of 100 MVA at unity power factor at 220 kV.	10 (2+3+5)	CO1, CO2
2	(a) What do you mean by ACSR? Explain how frequency affects AC resistance? (b) Find the expression of inductance of a single phase line. (c) A 220-kV, 50 hz, three-phase transmission line is 120 km long. The line has a per phase series impedance of $z=0.05+j0.45$ $\Omega$ per km and a per phase shunt admittance $y=j3.4 \times 10^{-6}$ siemens per km. Using nominal $\pi$ model determine the transmission line A, B, C, and D constants. Find the voltage regulation.	10 (2+3+5)	CO1, CO2
<b>Section B</b>			
3.	What do you mean by tariff? Describe the desirable characteristics of a tariff  Calculate annual bill of a consumer whose maximum demand is 100 KW, 0.8 power factor lagging and load factor is 60%. The tariff used is 75 per KVA of maximum demand plus 15 paise per KWh consumed.	10 (1+2+7)	CO3
4.	The load on an installation is 800 KW, 0.8 lagging power factor, which works for 3000 hours per annum. The tariff is Rs. 100 per KVA plus 20 paise per KWh. If the power factor is improved to 0.9	10	CO4

**Course Outcomes**

CO1: Given Specification leads to design of network, choice of optimal Voltage, Transmission line and its material

CO2: Given Specification leads to study of suitable system parameters and incorporating laws of Power systems to choose the most applicable.

CO3: Given Specification emphasizes on the different Tariff structures, by which one can able to judge, compare and select a suitable Tariff plan.

CO4: Given Specification facilitates the design of equipment's on the basis of power factor.

	lagging by means of loss free capacitor costing of Rs. 60 per KVAR, calculate the amount saving. Allow 10 % per annum for interest and depreciation on capacitors		
5.	Derive an expression for the most economical value of power factor which may be attained by a consumer  A consumer has a maximum demand of 200 KW at 40 % load factor. If the tariff is Rs. 100 per kw of maximum demand plus 10 paisa per kwh, find the overall cost per KWh.	10 (5+5)	C03, C04