Indian Institute of Technology Patna
Department of Electrical Engineering

EE3101-Power Systems-I

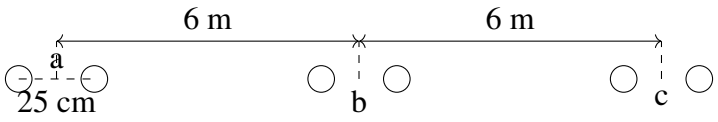
End Semester Exam

Time: 3 Hours | Autumn 2026 | Max Marks: 50

All questions are compulsory

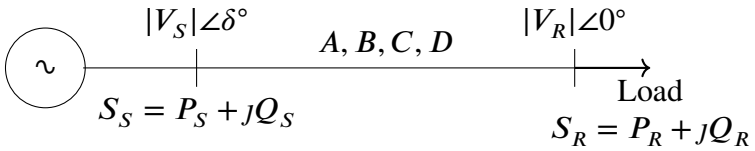
1. An industry has an average electrical load of 600 kW at a p.f. of 0.6 lagging. A synchronous motor with an efficiency of 90% is used to raise the combined p.f. to 0.9 lagging and at the same time supply a mechanical load of 100 kW. Calculate
   (a) the kVA of the synchronous motor **(5)**
   (b) the synchronous motor operating power factor. **(5)**

2. Consider the following single circuit, two-bundle and 200 km long line. The diameter of each conductor is 5 cm. ($\epsilon_0 = 8.854 \times 10^{-12} F/m$) Determine



   (a) the total series reactance in Ω. **(5)**
   (b) the total shunt admittance in ℧ **(5)**

3. For a two bus system shown below, derive expressions for real power at receiving end and sending end in terms of A, B, C, D parameters. Also show that the sending end and receiving end real power are equal for a loss less system having a short transmission line. Let A, B, C and D be $|A|\angle\alpha$, $|B|\angle\beta$, $|C|\angle\gamma$ and $|A|\angle\alpha$, respectively. **(10)**



4. A transmission line has the following parameters :

$$A = D = 1\angle 5°; B = 88\angle 75°$$

   (a) Determine the sending-end voltage and the voltage regulation if the line supplies a load of 40 MW at 0.8 p.f. lagging with receiving-end voltage 132 kV. **(5)**
   (b) Find the real power, reactive power and power factor of the load if the voltages at the two ends are 132 kV and with a phase difference of 30°. **(5)**

5. 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)**