EE - 2015

AI24BTECH11015 - Harshvardhan Patidar

1) A $50Hz$ generating unit has H-constant of $2MJ/MVA$. The machine is initially operating in steady state at synchronous speed, and producing $1pu$ of real power. The initial value of the rotor angle δ is $5°$, when a bolted three phase to ground short circuit fault occurs at the terminal of the generator. Assuming the input mechanical power to remain at $1pu$, the value of δ in degrees, 0.02 seconds after the fault is ________.
2) A sustained three-phase fault occurs in the power system shown in the figure 2.1. The current and voltage phasors during the fault(on a common reference), after the natural transients have died down, are also shown. Where is the fault located?

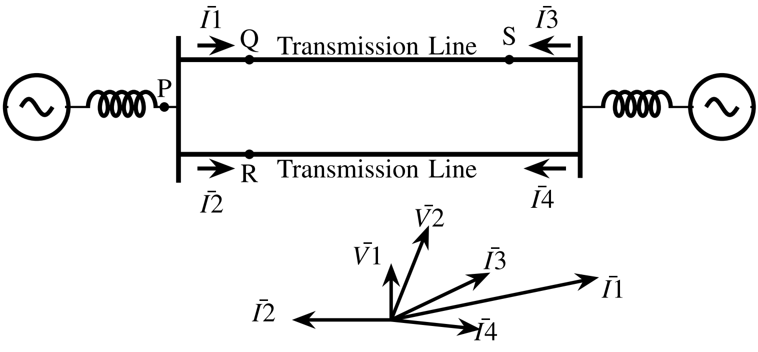

Fig. 2.1

a) Location P
b) Location Q
c) Location R
d) Location S

3) The circuit shown in the figure 3.1 has two sources connected in series. The instantaneous voltage of AC source (in Volt) is given by $v(t) = 12\sin t$. If the circuit is in steady state, then the rms value of the current (in Ampere) flowing in the circuit is ________.

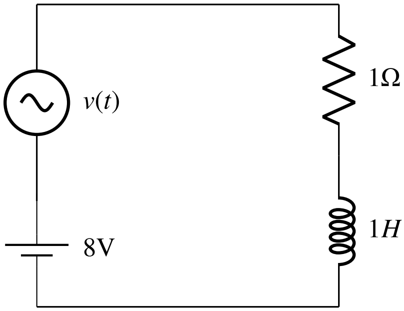

Fig. 3.1

4) In a linear two-port network, when $10V$ is applied to Port 1, a current of $4A$ flows through Port 2 when it is short-circuited. When $5V$ is applied to Port 1, a current of $1.25A$ flows through a 1Ω resistance connected accros Port 2. When $3V$ is applied to Port 1, the current (in Ampere) through a 2Ω resistance connected across Port 2 is _________.
5) In the given circuit, the parameter k is positive, and the power dissipated in the 2Ω resistor is 12.5W. The value of k is _________.

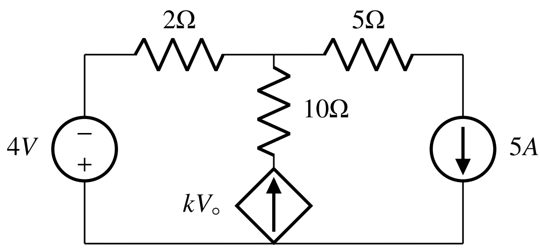

Fig. 5.1

6) A separately excited DC motor runs at 1000 rpm on no load when its armature terminals are connected to a $200V$ DC source and the rated voltage is applied to the field winding. The armature resistance of this motor is 1Ω. The no-load armature current is negligible. With the motor developing its full load torque, the armature voltage is set so that the rotor speed is 500 rpm. When the load torque is reduced to 50% of the full load value under the same armature voltage conditions, the speed rises to 520 rpm. Neglecting the rotational losses, the full load armature current (in Ampere) is _________.
7) A DC motor has the following specifications: 10 hp, $37.5A$, $230V$; flux / pole = 0.01 Wb, number of poles = 4, number of conductors = 666, number of parallel paths = 2. Armature resistance = 0.267Ω. The armature reaction is negligible and rotational losses are $600W$. The motor operates from a $230V$ DC supply. If the motor runs at 1000 rpm, the output torque produced (in Nm) is _________.
8) A 200/400V, 50Hz, two-winding transformer is rated to 20kVA. Its windings are

connected as an auto-transformer of rating 200/600V. A resistive load of 12Ω is connected to the high voltage (600V) side of the auto-transformer. The values of equivalent load resistance (in Ohm) as seen from low voltage side is _________.

9) Two single-phase transformers T_1 and T_2 each rated at 500kVA are operated in parallel. Percentage impedances of T_1 and T_2 are $(1 + j6)$ and $(0.8 + j4.8)$, respectively. To share a load of 1000kVA at 0.8 lagging power factor, the contribution of T_2(in kVA) is _________.

10) In the signal flow diagram given in the figure 10.1, u_1 and u_2 are possible inputs whereas y_1 and y_2 are possible outputs. When would the SISO system derived from this diagram be controllable and observable?

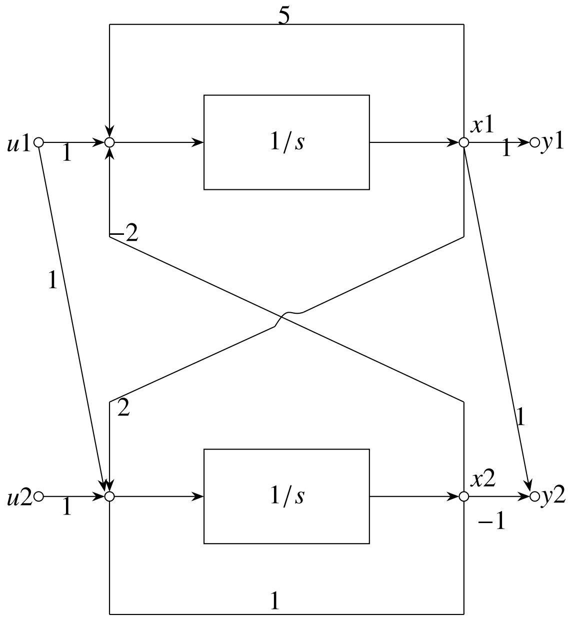

Fig. 10.1

a) When u_1 is the only input and y_1 is the only output.
b) When u_2 is the only input and y_1 is the only output.
c) When u_1 is the only input and y_2 is the only output.
d) When u_2 is the only input and y_2 is the only output.

11) The transfer function of a second order real system with a perfectly flat magnitude response of unity has pole at $(2 - j3)$. List all the poles and zeroes.

a) Poles at $(2 \pm j3)$, no zeroes.
b) Poles at $(\pm 2 - j3)$, one zero at origin.
c) Poles at $(2 - j3)$, $(-2 + j3)$, zeroes at $(-2 - j3), (2 + j3)$
d) Poles at $(2 \pm j3)$, zeroes at $(-2 \pm j3)$

12) Find the transfer function $\frac{Y(s)}{X(s)}$ of the system given below.

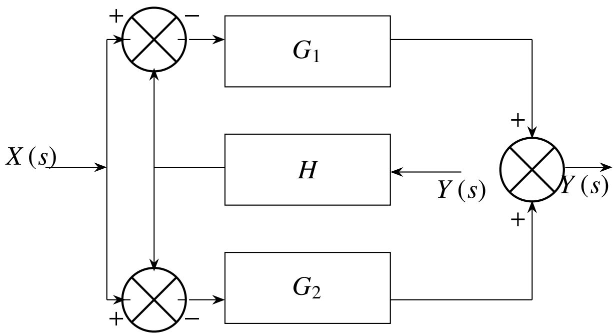

Fig. 12.1

a) $\frac{G_1}{1-HG_1} + \frac{G_2}{1-HG_2}$
b) $\frac{G_1}{1+HG_1} + \frac{G_2}{1+HG_2}$
c) $\frac{G_1+G_2}{1+H(G_1+G_2)}$
d) $\frac{G_1+G_2}{1-H(G_1+G_2)}$

13) The open loop poles of a third order unity feedback system are $0, -1, -2$. Let the frequency corresponding to the point where locus of the system transits to unstable region be K. Now suppose we introduce a zero in the open loop transfer function at -3, while keeping all the earlier open loop poles intact. Which one of the following is TRUE about the point where the root locus of the modified system transits to unstable region?

a) It corresponds to a frequency greater than K
b) It corresponds to a frequency less than K
c) It corresponds to a frequency K
d) Root locus of modified system never transits to unstable region