

GATE Questions 3

EE24BTECH11012 - Bhavanisankar G S

- 1) A lossless power system has to serve a load of 250MW. There are two generators G1 and G2 in the system with cost curves C_1 and C_2 respectively defined as follows :

$$C_1(P_{G1}) = P_{G1} + 0.055 \times P_{G1}^2$$

$$C_2(P_{G2}) = 3P_{G2} + 0.03 \times P_{G2}^2$$

where P_{G1} and P_{G2} are the MW injections from generator G1 and G2 respectively. Then the cost dispatch will be

- a) $P_{G1} = 250MW, P_{G2} = 0MW$ c) $P_{G1} = 100MW, P_{G2} = 150MW$
b) $P_{G1} = 150MW, P_{G2} = 100MW$ d) $P_{G1} = 0MW, P_{G2} = 250MW$

- 2) A lossless single machine infinite bus power system is shown below:

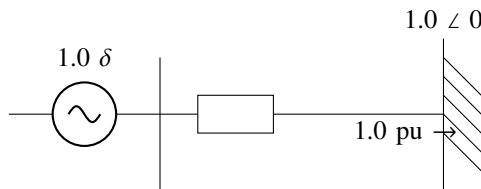


Fig. 2.

The synchronous generator transfers 1.0 per unit of power to the infinite bus. The critical clearing time of circuit breaker is 0.28s. If another identical synchronous generator is connected in parallel to the existing generator and each generator is scheduled to supply 0.5 per unit of power, then the critical clearing time of the circuit breaker will

- a) reduce to 0.14 s c) remain constant at 0.28 s
b) reduce but will be more than 0.14 s d) increase beyond 0.28 s
- 3) Single line diagram of a 4-bus single source distribution system is shown below. Branches e_1 , e_2 , e_3 and e_4 have equal impedances. The load current values indicated on the figure are in per unit.

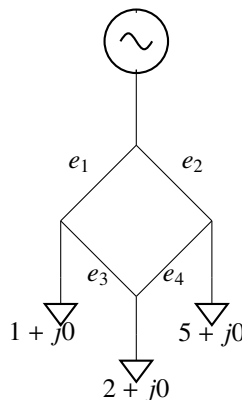


Fig. 3.

Distribution company's policy requires radial system operation with minimum loss. This can be achieved by opening of the branch

- a) e_1 b) e_2 c) e_3 d) e_4

4) A single phase fully controlled bridge converter supplies a load drawing constant and ripple-free load current. If the triggering angle is 30° , the input power factor will be

- a) 0.65 b) 0.78 c) 0.85 d) 0.866

5) A single-phase half controlled converter shown in the figure is feeding power to highly inductive load. The converter is operating at a firing angle of 60° .

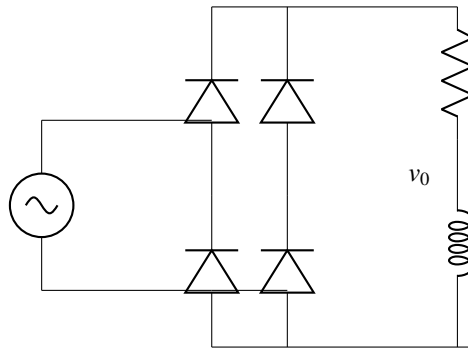


Fig. 5.

If the firing pulses are suddenly removed, the steady state voltage (v_0) waveform of the converter will become

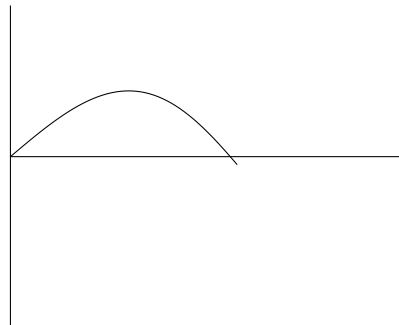


Fig. 5.

a)

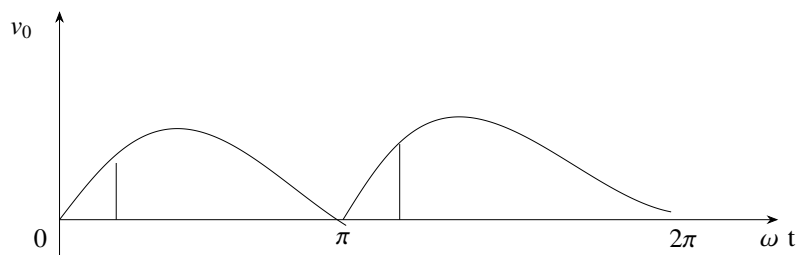


Fig. 5.

b)

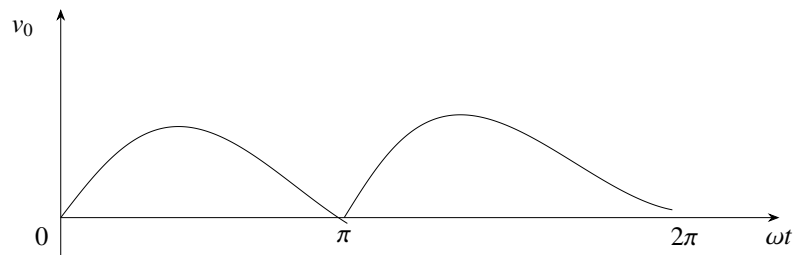


Fig. 5.

c)

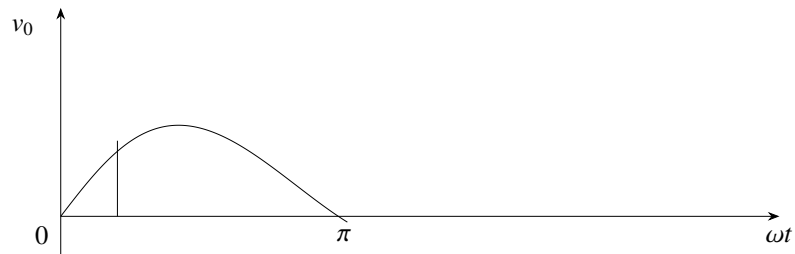


Fig. 5.

d)

- 6) A 200V, 20A, 1000rpm separately excited DC motor has an armatur resistance of 0.4Ω . The motor is fed from a single phase circulating current dual converter with an input AC line voltage of 220V (rms) . The approximate firing angles of the dual converter for the motoring operation at 50 % of the rated torque and 1000 rpm will be

a) $43^\circ, 137^\circ$ b) $43^\circ, 47^\circ$ c) $39^\circ, 141^\circ$ d) $39^\circ, 51^\circ$

- 7) A 220 V, 20A, 1000rpm separately excited DC motor has an armature resistance of 2.5Ω . The motor is controlled by a step-down chopper with a frequency of 1kHz. The input DC voltage to the chopper is 250V. The duty cycle of the chopper for the motor to operate at a speed of 600 rpm delivering the rated torque will be

a) 0.518 b) 0.608 c) 0.852 d) 0.902

- 8) A single phase voltage converter is feeding a purely inductive load as shown in the figure.

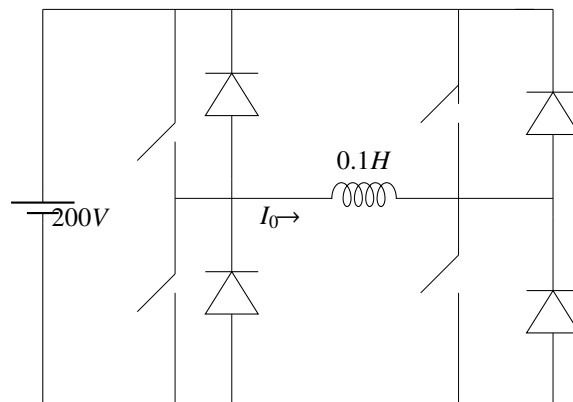


Fig. 8.

The inverter is operated at 50Hz in 180 ° square wave mode. Assume that the load current does not have any DC component. The peak value of the inductor current i_0 will be

- a) 6.37 A b) 10 A c) 20 A d) 40 A

- 9) A 400V, 50Hz, 4 pole, 1400 rpm star connected squirrel cage induction motor has the following parameters referred to the stator:

$$R_r = 1.0\Omega; X_s = X_r = 1.5\Omega$$

Neglect stator resistance and core and rotational losses of the motor. The motor is controlled from a 3-phase voltage source inverter with constant V/f control. The stator line-to-line voltage (rms) and frequency to obtain the maximum torque at starting will be

- a) 20.6V, 2.7Hz c) 266.6V, 33.3Hz
b) 133.3V, 16.7Hz d) 323.3V, 40.3Hz

- 10) A single phase fully controlled converter bridge is used for electrical braking of a separately excited DC motor. The DC motor load is represented by an equivalent circuit as shown in the figure.

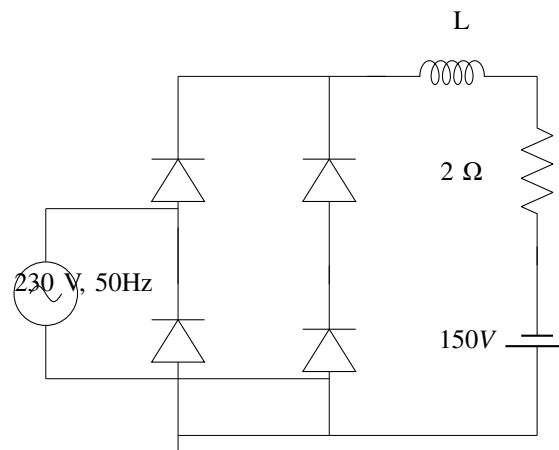


Fig. 10.

Assume that the load inductance is sufficient to ensure continuous and ripple free load current. The firing angle of the bridge for a load current of $I_0 = 10A$ will be

- a) 44 ° b) 51 ° c) 129 ° d) 136 °

- 11) A three phase fully controlled bridge converter is feeding a load drawing a constant and ripple-free load current of 10A at a firing angle of 30 °. The approximate Total Harmonic Distortion (%THD) and the rms value of fundamental component of the input current will be respectively

- a) 31 % and 6.8 A c) 66 % and 6.8 A
b) 31 % and 7.8 A d) 66 % and 7.8 A

- 12) In the circuit shown in the figure, the switch is operated at a duty-cycle of 0.5. A large capacitor is connected across the load. The inductor current is assumed to be continuous.

- a) 3 poles and 1 zero
- b) 2 poles and 1 zero
- c) 2 poles and 2 zeroes
- d) 1 pole and 2 zeroes

16) The range of K for which the system $\frac{K}{s(s+3)(s+10)}$ is stable will be given by

- a) $0 \leq K \leq 30$
- b) $0 \leq K \leq 39$
- c) $0 \leq K \leq 390$
- d) $K > 390$

17) The transfer function of a system is given by

$$\frac{100}{s^2 + 20s + 100}$$

This system is

- a) an overdamped system
- b) an underdamped system
- c) a critically damped system
- d) an unstable system