Unit 8 - Week 6

Assignment 6

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-10-28, 23:59 IST.

1) A DC motor has an armature resistance of 0.5 Ω. The back emf constant (K) of the motor is 0.25 V/(rad./s). The motor is connected to a fan blade whose load characteristic is described by $T_l = 0.0015\,\omega^2$, where ω is the speed in rad/s. If it is intended to operate the fan blades at a speed of 60 (rad./s), determine the armature input voltage (in V) that needs to be supplied to the motor. Do the calculations correct to 1 decimal place.

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 24,26.5

1 point

2) A DC motor has an armature resistance of 0.5 Ω. The back emf constant (K) of the motor is 0.25 V/(rad./s). The motor is connected to a fan blade whose load characteristic is described by $T_l = 0.0015\,\omega^2$, where ω is the speed in rad/s. The armature terminals of the motor are energized from a buck (step down) DC/DC converter which in turn is fed from a 100 V DC source. If it is intended to operate the fan blades at a speed of 60 rad./s, determine on-duration of the switch (in μs) if the switching frequency is chosen to be 5 kHz. Do the calculations correct to 1 decimal place

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 51,52

1 point

3) A DC motor has armature resistance of 0.5 Ω and an armature inductance of 2 mH. The back emf constant (K) of the motor is 0.25 V/(rad./s). The motor is connected to a fan blade whose load characteristic is described by $T_l = 0.0015\,\omega^2$, where ω is the speed in rad/s. The armature terminals of the motor are energized from a buck converter which in turn is fed from a 100 V DC source. Determine the peak to peak value of ripple in the armature current (in A) , when the fan blades are intended to operate at a speed of 60 rad./s. Do the calculations correct to 3 decimal places

No, the answer is incorrect.
Score: 0
Accepted Answers:
(Type: Range) 1.9,1.92

1 point

4) A permanent magnet DC motor supplied from a buck DC/DC converter runs at a certain operating speed. While the load torque remaining constant, if the operating speed is increased **1 point**

- The slope of the rising profile of inductor current increases and the slope of the falling profile reduces
- The slopes of rising and falling profiles of inductance current are unchanged
- The slope of the rising profile of the inductor current reduces and the slope of the falling profile increases
- The slopes of rising and falling profiles of inductance current decreases.

No, the answer is incorrect.
Score: 0
Accepted Answers:
The slope of the rising profile of the inductor current reduces and the slope of the falling profile increases

5) An H-bridge DC/DC converter comprises of **1 point**

- 4 fully controlled devices and 4 uncontrolled devices
- 2 fully controlled devices and 2 uncontrolled devices
- only 4 uncontrolled devices.
- 4 fully controlled devices and 2 uncontrolled devices

No, the answer is incorrect.
Score: 0
Accepted Answers:
4 fully controlled devices and 4 uncontrolled devices

6) Consider two design variants of DC motors both having the same ratings of speed, power and magnetic fields - (a) permanent magnet DC motor and (b) wound field DC motor. For these, pick out the correct statements **1 point**

- Overall size of (a) is smaller than (b).
- It is feasible to operate (a) at speeds above the rated speed, while it is not so easy to operate (b) beyond the rated speed
- (b) does not require a commutator-brush assembly
- The stator design of (a) and (b) are alike

No, the answer is incorrect.
Score: 0
Accepted Answers:
Overall size of (a) is smaller than (b).

7) The speed of a DC motor is controlled till its rated speed by adjusting the armature terminal voltage by a suitable mechanism. In this case, **1 point**

- the maximum torque that can be generated by the motor decreases as the speed decreases
- the maximum torque that can be generated by the motor remains equal to the rated value at any operating speed
- the maximum torque that can be generated by the motor increases as the speed decreases
- the maximum mechanical power that can be generated by the motor remains equal to its rated value at any operating speed

No, the answer is incorrect.
Score: 0
Accepted Answers:
the maximum torque that can be generated by the motor remains equal to the rated value at any operating speed

8) The purpose of a freewheeling diode in a DC/DC converter is to **1 point**

- reduce the current flowing through the switch during its ON duration
- Improve the voltage gain of the converter
- prevent the interruption of inductor current
- reduce the duty ratio of the control switch.

No, the answer is incorrect.
Score: 0
Accepted Answers:
prevent the interruption of inductor current

9) In a DC/DC converter, if the switching frequency is increased while maintaining the duty ratio constant **1 point**

- the average value of output voltage increases.
- the average value of output voltage remains constant
- The peak to peak ripple in inductor current reduces
- The average value of inductor current reduces.

No, the answer is incorrect.
Score: 0
Accepted Answers:
the average value of output voltage remains constant
The peak to peak ripple in inductor current reduces

10) A permanent magnet DC motor is supplied from a H bridge DC/DC converter. The input voltage to the converter is 24 V DC. The switches of the converter are numbered as follows: 1 and 4 refer to the top and bottom switches of the first leg. 3 and 2 refer to the top and bottom switches of the second leg. The switches 1 and 2 are operated together and similarly 3 and 4 are operated together. If the average voltage required by the motor for operating at a particular speed is 16 V, determine the duty ratio of switches 1 and 2 **1 point**

- 0.25
- 0.67
- 0.33
- 0.83

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.83

11) A permanent magnet DC motor is supplied from a H bridge DC/DC converter. The input voltage to the converter is 24 V DC. The switches of the converter are numbered as follows: 1 and 4 refer to the top and bottom switches of the first leg. 3 and 2 refer to the top and bottom switches of the second leg. The switches 1 and 2 are operated together and similarly 3 and 4 are operated together. The switching frequency is 10 kHz. If the average voltage required by the motor for operating at a particular speed is 16 V, determine the ON duration of switches 3 and 4 **1 point**

- 16.6 μs
- 34 μs
- 68 μs
- 132 μs

No, the answer is incorrect.
Score: 0
Accepted Answers:
16.6 μs

12) A H bridge DC/DC converter can make a DC motor operate in ___ quadrants **1 point**

- 1
- 2
- 3
- 4

No, the answer is incorrect.
Score: 0
Accepted Answers:
4

13) . In a typical closed loop cascaded control structure of a DC motor for a position control application, the speed of response of the control variables - position, speed and torque to their corresponding reference values are in the order **1 point**

- position > speed > torque
- position > torque > speed
- torque > speed > position
- torque > position > speed

No, the answer is incorrect.
Score: 0
Accepted Answers:
torque > speed > position

14) A permanent magnet DC motor is supplied from a H bridge DC/DC converter. The input voltage to the converter is 24 V DC. The switches of the converter are numbered as follows: 1 and 4 refer to the top and bottom switches of the first leg. 3 and 2 refer to the top and bottom switches of the second leg. The switches 1 and 2 are operated together and similarly 3 and 4 are operated together. The gating pulses to the switches of the converter are derived by PWM operation by comparing the reference voltage with a bipolar triangular waveform of frequency 10 kHz and amplitude 10 V **1 point**

The motor has an armature resistance of 0.5 Ω and a speed-emf constant (K) equal to 0.2 V/rad./s. A constant load of 0.4 Nm is driven by the motor while operating at a speed of 50 rad./s. The magnitude of reference voltage in this case is approximately,

- 4.6 V
- 7.3 V
- 5.4 V
- 2.7 V

No, the answer is incorrect.
Score: 0
Accepted Answers:
4.6 V

15) Consider a statement (S) made about a buck DC/DC converter and a reason (R) assigned to it. **1 point**

S: It is not possible to operate a DC motor energized from a buck (step down) DC/DC converter in both the directions of rotation.
R: The average output voltage that can be derived from a buck converter ranges from $0 \leq V_a \leq V_g$, where V_g is the input DC voltage. Of these,

- Both (S) and (R) are true and (R) is the correct reason for (S).
- Both (S) and (R) are true and (R) is not the correct reason for (S)
- (S) is true and (R) is false
- Both (S) and (R) are not true

No, the answer is incorrect.
Score: 0
Accepted Answers:
Both (S) and (R) are true and (R) is the correct reason for (S).