

## Unit 9 - Week 7

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## Assignment 7

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

Due on 2020-11-04, 23:59 IST.

- 1) The waveform of induced emf in a BLDC motor when the rotor is rotated at a constant speed is 1 point
- alternating and sinusoidal  
 alternating , but not sinusoidal  
 constant  
 unipolar with a superimposed ripple.
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*alternating , but not sinusoidal*
- 2) Among the following statements made about the geometry of a brushless DC motor, pick out the correct one(s). 1 point
- The rotor of a BLDC motor houses the armature and the stator houses the field  
 The construction of the rotor of a BLDC motor is similar to that of a PMDC motor except that the BLDC rotor does not need a commutator-brush assembly  
 The rotor of a BLDC motor houses the field system and the stator houses the armature  
 The construction of the stator of a BLDC motor is similar to that of a DC motor
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*The rotor of a BLDC motor houses the field system and the stator houses the armature*
- 3) The magnitude of the flat portion and the frequency of the induced emf in a BLDC motor while the rotor rotates at a certain speed are  $E_1$  and  $f_1$  respectively. If the speed of rotation of the rotor is halved, then the magnitude of flat portion and frequency of induced emf respectively becomes 1 point
- $2E_1$  and  $2f_1$   
  
 $E_1$  and  $f_1/2$   
  
 $E_1/2$  and  $f_1/2$   
  
 $E_1/4$  and  $f_1/2$
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
 *$E_1/2$  and  $f_1/2$*
- 4) The resistance of each phase winding of a BLDC motor is  $0.4 \Omega$ . The magnitude of the flat portion of the induced emf in each phase ( $E_b$ ) of the machine is given by  $E_b = 0.2\omega$ , where  $\omega$  is the speed of the rotor in rad./s. The DC input voltage to the inverter is 100 V. In every  $60^\circ$  interval, the respective active switches of the inverter are operated at a duty ratio of 0.8, at an operating speed of 60 rad./s. Determine the average value of armature current flowing through the phase windings in this case.
- 
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*(Type: Range) 44,46*
- 5) For an inverter driving a BLDC motor 1 point
- there are two switches active in every  $60^\circ$  angular interval of the rotor position  
 each switch conducts for a total angular duration of  $120^\circ$ .  
 in every  $30^\circ$  interval, the pair of active switches involved in conduction gets changed  
 at any instant, there will always be one switch ON in each leg.
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*there are two switches active in every  $60^\circ$  angular interval of the rotor position each switch conducts for a total angular duration of  $120^\circ$ .*
- 6) From the following statements made about Hall effect switches, identify the correct one(s). 1 point
- The output of each hall switch alternates between high and low at every  $120^\circ$   
 The output signals from the hall switches are identical except for a phase shift between each other  
 The output state of a hall switch depends not only on the rotor position, but also on the direction of rotation of the rotor  
 It is possible to uniquely describe the conduction period of any switch by the output status of two hall switches
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*The output signals from the hall switches are identical except for a phase shift between each other It is possible to uniquely describe the conduction period of any switch by the output status of two hall switches*
- 7) The rotor of a BLDC motor rotates at a speed of 600 rpm. The rotor of the BLDC has only one North pole and one South pole. The frequency of the output pulses from each hall effect switch is \_\_\_\_\_ Hz
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- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*(Type: Range) 9,11*
- 8) When the operating speed of a BLDC motor increases, the frequency of torque ripple 1 point
- increases in proportion to the speed  
 decreases  
 increases but not in proportion to the speed  
 remains unchanged
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*increases in proportion to the speed*
- 9) When the direction of rotation of a BLDC motor reverses 1 point
- the polarities of induced emf of any phase at a given rotor position gets reversed as compared to the case of forward rotation  
 the magnitude of induced emf increases during reverse operation since the rate of change of flux linkage of phase winding increases  
 the frequency of induced emf increases during reverse operation  
 the relative phase sequence of the induced emfs gets reversed
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*the polarities of induced emf of any phase at a given rotor position gets reversed as compared to the case of forward rotation the relative phase sequence of the induced emfs gets reversed*
- 10) The switching logic for operating the inverter switches in a BLDC motor drive cannot be employed in PMSM, though the inverter topology remains the same. This is because 1 point
- PMSM operation necessitates a sinusoidal current flow while BLDC demands a DC current while each phase conducts  
 BLDC does not need a PWM operation and it is just enough to switch the devices once in every  $60^\circ$  angular interval  
 BLDC can be operated with a unipolar current waveform since the back emfs are flat topped, while a PMSM needs a bipolar current flow  
 BLDC can be operated with a unipolar voltage across each phase since the back emfs are flat topped, while a PMSM needs bipolar voltages across each phase
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*PMSM operation necessitates a sinusoidal current flow while BLDC demands a DC current while each phase conducts*
- 11) BLDC motors are not used in robotic applications that need very precise speed control because 1 point
- there is an inherent torque ripple in the case of BLDC.  
 the estimation of speed using hall switches is inaccurate and therefore need additional apparatus for speed sensing  
 BLDC motors have very less moment of inertia.  
 they cannot be operated in two directions
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*there is an inherent torque ripple in the case of BLDC. the estimation of speed using hall switches is inaccurate and therefore need additional apparatus for speed sensing*
- 12) The rotor of a PMSM houses the field arrangement made of two permanent magnets - one with north pole facing outwards and the other with south pole facing outwards. The induced emf of one phase of a PMSM is measured to have a frequency of 45 Hz, while the rotor rotates at a certain speed. The speed of rotation of the motor is then \_\_\_\_\_rpm
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- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*(Type: Range) 2690,2710*
- 13) Two switches on the same leg of an inverter are never turned ON together because, 1 point
- it may lead to unnecessary voltage drops  
 the phase winding of the motor expects only unidirectional current to flow  
 the switching logic becomes complicated  
 the DC voltage source gets short-circuited and is highly dangerous
- No, the answer is incorrect.  
Score: 0  
Accepted Answers:  
*the DC voltage source gets short-circuited and is highly dangerous*