



Faculty of Engineering

End Semester Examination May 2025

AU3EL15 Motors & Controllers

Programme	: B.Tech.	Branch/Specialisation	: AU
Duration	: 3 hours	Maximum Marks	: 60

Note: All questions are compulsory. Internal choices, if any, are indicated. Assume suitable data if necessary.

Notations and symbols have their usual meaning.

Section 1 (Answer all question(s))		Marks	CO	BL
Q1.	Which of the following motors strictly require an alternating current supply for operation?	1	1	1
	<input type="radio"/> BLDC <input type="radio"/> PMSM <input type="radio"/> SRM <input checked="" type="radio"/> Induction			
Q2.	What is the main advantage of a Brushless DC (BLDC) motor compared to a conventional DC motor?	1	1	1
	<input type="radio"/> Lower efficiency due to the absence of brushes <input checked="" type="radio"/> Reduced maintenance and longer lifespan <input type="radio"/> Requires a mechanical commutator for operation <input type="radio"/> Higher friction losses due to permanent magnets			
Q3.	In a DC motor, which component is responsible for supplying power to the armature?	1	2	1
	<input type="radio"/> Brushes <input checked="" type="radio"/> Commutator <input type="radio"/> Field winding <input type="radio"/> Stator			
Q4.	Which of the following best describes the torque-speed characteristic of an induction motor?	1	2	1
	<input type="radio"/> Linear relationship between torque and speed <input type="radio"/> Torque is maximum at synchronous speed <input checked="" type="radio"/> Torque initially increases, reaches a peak, and then decreases with speed <input type="radio"/> Torque remains constant regardless of speed			
Q5.	Which is not a semiconductor material?	1	3	1
	<input type="radio"/> Silicon (Si) <input checked="" type="radio"/> Aluminium Carbide (AlC) <input type="radio"/> Gallium Arsenide (GaAs) <input type="radio"/> Silicon Carbide (SiC)			
Q6.	What is the purpose of doping in semiconductors?	1	3	1
	<input type="radio"/> To increase electrical resistance <input checked="" type="radio"/> To increase charge carriers <input type="radio"/> To enhance mechanical strength <input type="radio"/> To make the material an insulator			
Q7.	Which speed control method keeps the voltage-to-frequency ratio constant in AC motors?	1	4	1
	<input type="radio"/> Scalar Control <input checked="" type="radio"/> V/f Control <input type="radio"/> Vector Control <input type="radio"/> Direct Torque Control (DTC)			
Q8.	Which motor control technique provides the fastest torque response?	1	4	1
	<input type="radio"/> Scalar Control <input checked="" type="radio"/> Direct Torque Control (DTC) <input type="radio"/> Vector Control <input type="radio"/> V/f Control			
Q9.	Which method is commonly used in sensorless motor control to estimate rotor position?	1	5	1
	<input type="radio"/> Hall effect sensors <input checked="" type="radio"/> Kalman filter-based estimation <input type="radio"/> Optical encoders <input type="radio"/> Mechanical tachometers			

Q10. Which type of Pulse Width Modulation (PWM) technique is most commonly used in motor control for reducing harmonic distortion? 1 5 1

- ☒ Sinusoidal PWM
 ☐ Square Wave PWM
☐ Phase-Shift PWM
 ☐ Random PWM

Section 2 (Answer all question(s))

Marks CO BL

Q11. State three major difference between a DC motor and Brushless DC motor. 3 1 1

Rubric	Marks
three differences 3 marks	3

Q12. (a) Considering different factors, discuss the selection criteria for motors in various automotive applications. 7 1 2

Rubric	Marks
Different factors 3 marks	3
Selection criteria 4 marks explanation	4

(OR)

(b) Explain BLDC and Induction Motor with principle, construction and working and neat sketch:

Rubric	Marks
principle 2 marks construction 2 marks working 2 marks sketch 1 marks	7

Section 3 (Answer all question(s))

Marks CO BL

Q13. Draw torque vs speed and power vs speed characteristics for an AC motor. 2 2 1

Rubric	Marks
torque vs speed 1 marks power vs speed 1 marks	2

Q14. (a) Derive torque equation for an AC and DC motor. 8 2 4

Rubric	Marks
Torque equation for AC Motor	4
Torque equation for DC Motor	4

(OR)

(b) What are the various losses associated with the AC and DC motors?

Rubric	Marks
Various losses associated with AC 4 marks Various losses with DC 4 marks	8

Section 4 (Answer all question(s))

Marks CO BL

- Q15.** Define the following :
- Electrons and Holes
 - Semiconductor
 - BJT and IGBT

3 3 1

Rubric	Marks
one marks each three definition	3

- Q16. (a)** What are power Convertors? Mention their types and explain any two power convertors.

7 3 4

Rubric	Marks
power convertors 4 marks explanation of types 3 marks	7

(OR)

- (b)** What are transistors? Explain any one of the transistors with the help of a figure, including its principle, working, and applications.

Rubric	Marks
transistors 1 marks diagram 1 marks principle 2 marks working 2 marks applications 1 marks	7

Section 5 (Answer all question(s))

Marks CO BL

- Q17.** Name different types of controllers and explain anyone.

2 4 2

Rubric	Marks
naming 1 marks explain 1 marks	2

- Q18. (a)** What are the various role of controllers in electric and hybrid vehicle systems?

8 4 2

Rubric	Marks
various roles of controllers in electric 4 marks various roles pf controllers in hybrid 4 marks	8

(OR)

- (b)** Explain speed control techniques for AC and DC motors.

Rubric	Marks
speed control techniques for AC motors 4 marks speed control techniques for DC Motors 4 marks	8

Section 6 (Answer any 2 question(s))

Marks CO BL

- Q19.** Explain the working principle of Field-Oriented Control (FOC). How it improves motor performance compared to scalar control?

5 5 2

Rubric	Marks
working principle 2.5 marks improvement 2.5 marks	5

Q20. Compare and contrast open-loop and closed-loop control systems with suitable examples from motor control applications. 5 5 1

Rubric	Marks
open loop 2.5 marks closed loop 2.5 marks	5

Q21. Explain the role of Pulse Width Modulation (PWM) in motor control. Describe different PWM techniques used to control motor speed and torque. 5 5 1

Rubric	Marks
PWM explanation 2 marks PWM techniques with explanation 3marks	5
