

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 type="radio"/> Gallium Arsenide (GaAs)		
<input checked="" type="radio"/> Aluminium Carbide (AlC)		<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 type="radio"/> To enhance mechanical strength		
<input checked="" type="radio"/> To increase charge carriers		<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 type="radio"/> Vector Control		
<input checked="" type="radio"/> Direct Torque Control (DTC)		<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))

Q11. State three major difference between a DC motor and Brushless DC motor. Marks CO BL
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))

Q13. Draw torque vs speed and power vs speed characteristics for an AC motor. Marks CO BL
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

Rubric	Marks
one marks each three definition	3

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

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.

Rubric	Marks
naming 1 marks explain 1 marks	2

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

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?

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
