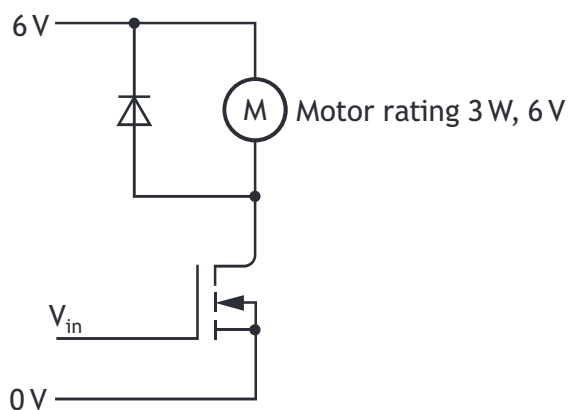


SECTION 1 — 20 marks
Attempt ALL questions

1. The motor driver circuit shown below is used to switch a motor on and off.



- (a) Calculate the resistance of the motor.
Show all working and final unit.

2

When the circuit is switched on, the resistance of the MOSFET is 0.5Ω .

- (b) Calculate the MOSFET drain current.
Show all working and final unit.

2

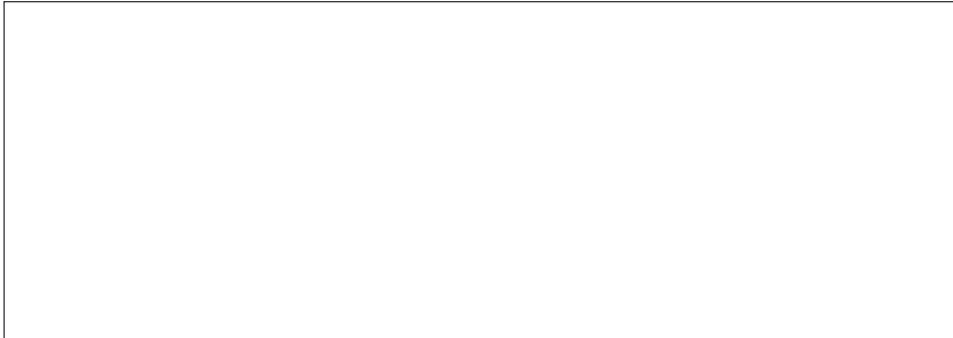
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1. (continued)

- (c) Calculate the power dissipated in the MOSFET when it is switched on.
Show all working and final unit.

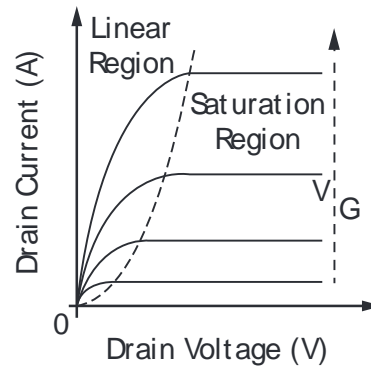
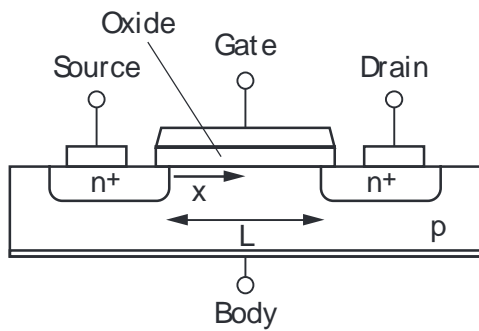
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3. Diagrams of a MOSFET and its characteristic operation curves are shown below. A MOSFET can be connected as a voltage operated switch.

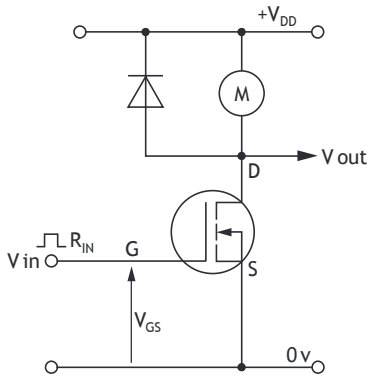


Describe the basic operation of a MOSFET switching device, making reference to the diagrams shown.

3

9. (continued)

An electronic engineer decided that one of the platform levelling motors would be controlled using the circuit shown below. The motor is controlled by a microcontroller using Pulse Width Modulation (PWM) and it is important the control system uses as little power as possible. The motor has a power rating of 12 V 200 W and the n-channel MOSFET has an R_{DS} value of 0.1Ω and is fully saturated.



(c) Explain why the electronic engineer might choose to use a MOSFET rather than a BJT for this particular application.

4

(d) Describe an emerging technology which may significantly change the design of transistors and other electronic components in the near future.

1

9. (continued)

(e) A particular levelling motion takes 2.3 s.

Calculate the energy dissipated in the MOSFET during the levelling motion.

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