

Brac University

Semester: Spring 2025

Course Code: CSE251

Electronic Devices and Circuits

Section: 01-30

Set
01

Assessment: *Final Exam*

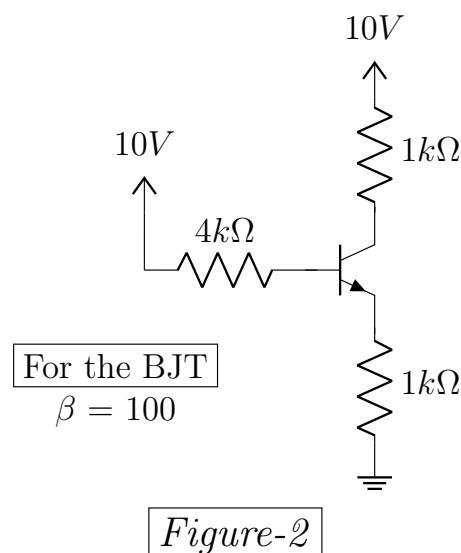
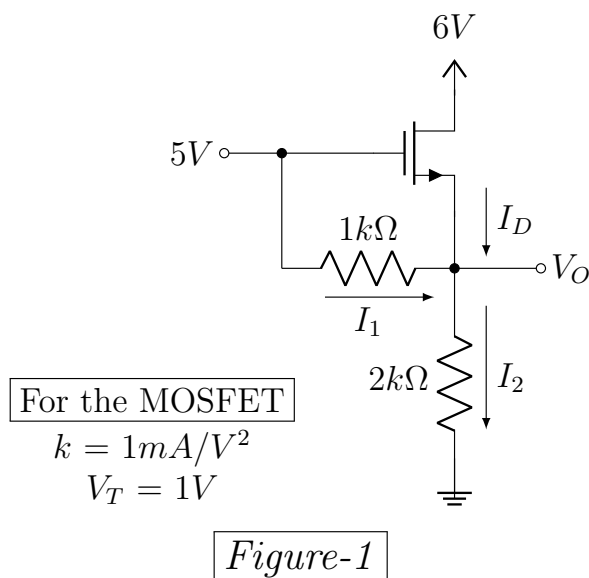
Duration: 1 hour 30 minutes

Date: 18 May, 2025

Full Marks: 50

===== Answer all questions =====

■ Question 1 [CO2] [20 marks]



- (a) [2 marks] **Analyze** the circuit in *Figure-1*, and **show** that, the MOSFET will operate in Saturation mode if it conducts current. [Hint: You don't need to solve the circuit]
- (b) [6 marks] **Analyze** the circuit in *Figure-1*, and **calculate** V_O , I_1 , I_2 & I_D using the method of assumed states. You must **validate** your assumption.

Equations of MOSFET

Cut-off Mode: $I_D = 0$

Triode Mode: $I_D = k [(V_{GS} - V_T)V_{DS} - \frac{1}{2}V_{DS}^2]$

Saturation Mode: $I_D = \frac{1}{2}k(V_{GS} - V_T)^2$

- (c) [8 marks] **Analyze** the circuit in *Figure-2*, and **calculate** I_B , I_C , I_E , V_C & V_E using the method of assumed states. You must **validate** your assumption.
- (d) [4 marks] **Analyze** the graph of the output voltage waveform of a rectifier circuit in *Figure-3*, and **calculate** the output frequency, f_{out} & average output voltage, V_{avg} (i.e. dc value of the output voltage, V_{dc}).

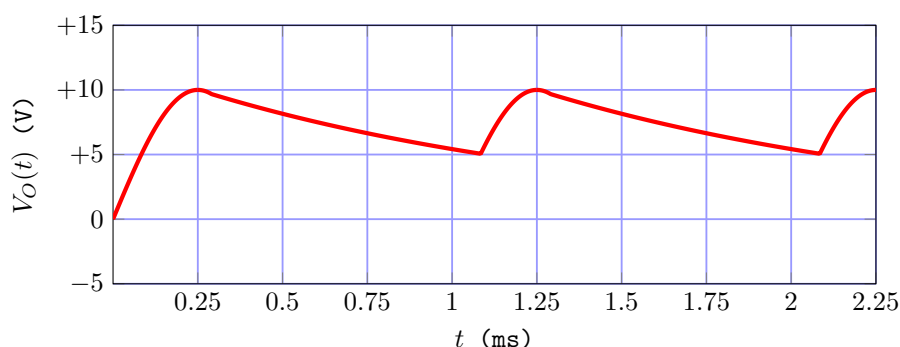


Figure-3

■ Question 2 [CO3] [20 marks]**Specifications**

- $V_{in} = 10\sin(200\pi t)$
- $f_{out} = 200Hz$
- $V_{D0} = 0.7V$
- $V_{r(p-p)} = 5\%$ of $V_{out(max)}$

- (a) [10 marks] **Analyze** the specifications given above, and **design** a rectifier circuit according to the specifications (i.e. **determine** the appropriate values of the rectifier components). **Assume** any value if necessary. Now, **draw** the designed circuit.
- (b) [10 marks] **Design** a circuit with boolean inputs A, B, and C using BJTs to implement the boolean logic function,

$$f = \overline{A}.B + \overline{B}.C + \overline{C}.A$$

■ Question 3 [CO1] [10 marks]

- (a) [4 marks] If V_{in} and V_{out} are the input and output voltages of a Full-Wave rectifier respectively with a cut-in voltage of V_{D0} for the diodes, **write** an equation relating V_{out} , V_{in} , and V_{D0} . Now, **draw** the Voltage Transfer Characteristics (VTC) graph of the rectifier and **label** the graph properly.
- (b) [2 marks] “MOSFETs can be used as electronic switches” - **Explain** the statement briefly.
- (c) [4 marks] **Draw** the I-V characteristics graph of a BJT. **Label** the graph properly and **identify** the different operating regions in the graph.