Ministry of Higher Education		
Manzala Higher Institute for Engineering and Technology		
First Semester :2020/2021		Date: 6/3/2021
Final Exam		Level: 1
Department: Electronic Eng.		Time allowed: 180 mins.
Total mark: 90		Code: COM113
Course title: Fundamentals of Electronic Engineering		

Answer all of the following questions. Justify your answers. Assume any missing data.

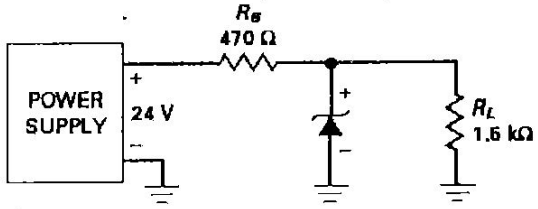
Q1: (20 marks)

a- What is the function of the (i) varactor, (ii) photo diode. (4 marks)

b- Sketch a bridge rectifier circuit. If the input sine wave to a bridge rectifier has peak voltage of 10 V, and silicon diodes are used, what is the output peak voltage? (6 marks)

c- If 30 white LEDs are connected in series to a 120 V source and a resistor,
(i) what is the value of the resistor so that the LEDs current is 20 mA (use white LED forward voltage of 3V)?
(ii) What is the total power delivered by the source? (5 marks)

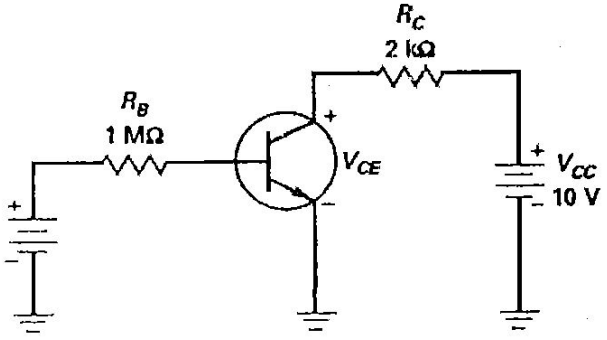
d- In the circuit shown, the Zener has a has a breakdown voltage of 10 V. Determine
(i) the load voltage, and
(ii) the Zener current.



(5 marks)

Q2: (45 marks)

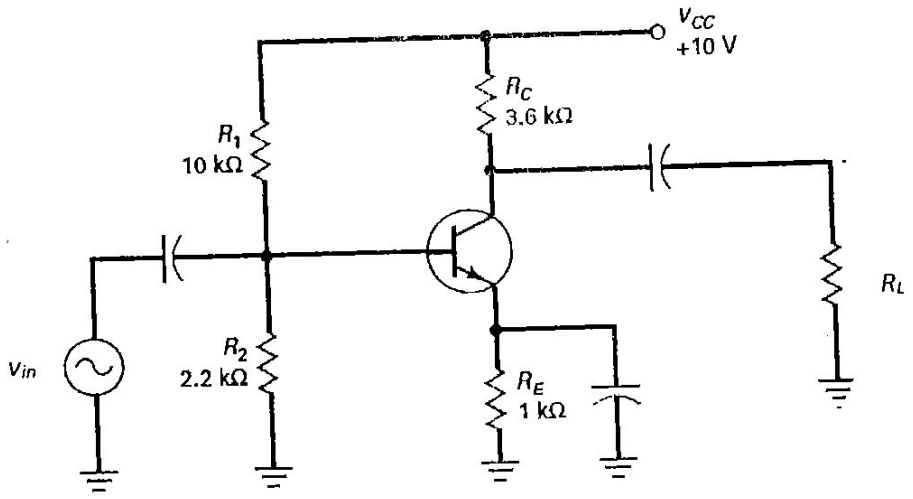
a- The transistor shown has a $\beta_{dc} = 200$, is the transistor Saturated or active? Calculate I_B, I_C, V_{CE}, and the dissipated power. Use $V_{BB} = 10$V.
(10 marks)



b- For the same circuit with $\beta_{dc} = 1000$, is the transistor Saturated or active? Explain. (7 marks)

c- For the same circuit, sketch the load-line (determine the collector current at the saturation point? The collector-emitter voltage at the cutoff point). (6 marks)

d- For the circuit shown next (assume the voltage divider is stiff) sketch the dc and the ac equivalent circuits (use the π-model). What is the voltage gain? What is the output voltage across the load resistor? Let $\beta_{dc} = 200$, $v_{in} = 1.5$ mV and $R_L = 15$ kΩ.
(22 marks)



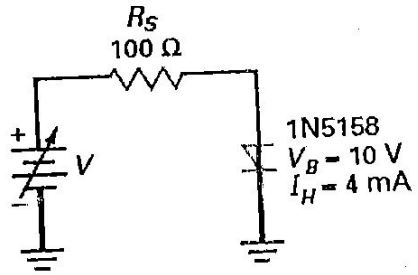
Q3: (25 marks)

a- (i) Which commonly has a larger input resistance, a JFET or a MOSFET? Why?
(ii) A JFET has a gate current of 3 nA when the reverse gate voltage is 15 V. What is the input resistance of this JFET? (5 marks)

b- A JFET has a $V_{GS(off)} = -3.0$ V and $I_{DSS} = 6$ mA. Find its ohmic resistance and pinchoff voltage values. (4 marks)

c- A D–MOSFET has the values $V_{GS(off)} = -5$ V and $I_{DSS} = 5$ mA. What will the drain current equal when V_{GS} equals –5 V and 0 V? Sketch the V_{GS}-I_{DS} curve. (4 marks)

d- The four-layer diode in the figure has a breakover voltage of 10 V.
(i) If the input voltage of is increased to 13 V, what is the diode current? (use second diode approximation with 0.7 V across the diode at the drop-out point).
(ii) What is the value of the voltage source that causes the diode to open if R_S is increased to 200 Ω? (6 marks)



e- The SCR shown has $V_{GT} = 1.0$ V, $I_{GT} = 2$ mA, and holding current = 10 mA.
(i) What is the output voltage when the SCR is off?
(ii) What is the input voltage that triggers the SCR?
(iii) If V_{CC} is decreased until the SCR opens, what is the value of V_{CC}? (6 marks)