College of Science.
Department of Physics & Astronomy

كلية العلوم
قسم الفيزياء والفلك

Final Exam
Academic Year 1443-1444 Hijri- SecondSemester

Exam Information معلومات الامتحان			
Course name	Electronic		اسم المقرر
Course Code	Phys 325	325 فيز	رمز المقرر
Exam Date	2022-06-07	1443-11-08	تاريخ الامتحان
Exam Time	8:00 AM		وقت الامتحان
Exam Duration	3 Hours		مدة الامتحان
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Student Information معلومات الطالب		
Student's Name		اسم الطالب
ID number		الرقم الجامعي
Section No.		رقم الشعبة
Serial Number		الرقم التسلسلي

This section is ONLY for instructor

#	Course Learning Outcomes (CLOs)	Related Question (s)	Points	Final Score
	N and P type semiconductor	1,2	2	40
	Quantum number	4	1	
	wave rectifier	3, Q5	4	
	PN junction diode ,Zener diode, light emitting diode (LED)	5,6,Q1,2,3,4	11	
	Bipolar junction transistor (BJT) transistor parameters	7,8,9,10,Q6,7,8	13	
	JFET, JFET characteristics curves	11,12,13,Q9,10	9	

Write all the answer of part1

Questions	1	2	3	4	5	6	7
answer							
Questions	8	9	10	11	12	13	
answer							

Part 1 (compulsory): (13 points) Choose the correct answer

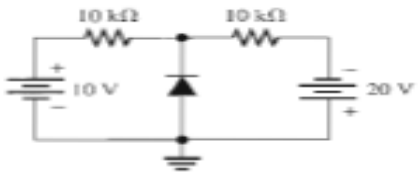
1. Holes in an n-type semiconductor are:
   a) majority carriers that are thermally produced .
   b) majority carriers that are produced by doping.
   c) minority carriers that are thermally produced.
   d) minority carriers that are produced by doping

2. The concentration of minority carriers in p-type semiconductor under equilibrium is:
   a)inversely proportional to the intrinsic concentration
   b)directly proportional to the doping concentration .
   c)inversely proportional to the doping concentration.
   d)none of the above.

3. If the load resistance of a capacitor-filter half-wave rectifier is reduced, the ripple voltage:
   a) increases
   b) decreases
   c) is not affected
   d) has a different frequency

4. The correct electronic configuration for the Germanium atom is :
   a) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^4$
   b) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2 4p^2$
   c) $1s^2 2s^2 2p^6 3s^2 3p^4$
   d) $1s^2 2s^2 2p^6 3s^2 3p^2$

5. The diode in the circuit below is:
   a) reverse-biased
   b) forward biased
   c) biasing depends whether it is Si
   d) biasing cannot be decided



6. An LED :
   a) senses light when forward biased
   b) senses light when reverse biased .
   c) emits light when reverse biased .
   d) emits light when forward biased .

7. 1. In a bipolar transistor, the concentration of impurities in the emitter layer is:
   a) Most concentration
   b) Equal to the base layer
   c) Equal to the collector layer
   d) Least concentration

8. A transistor has a β_{DC} of 250 and a base current, I_B, of 20μA. The collector current, I_C, equals:
   a) 500 μA
   b) 5 mA
   c) 50 mA
   d) 5 A

9. Four relation are given below. Identify the correct relation regarding a transistor.
   a) $I_E < I_C > I_B$
   b) $I_E + I_C = I_B$
   c) $I_E > I_C < I_B$
   d) $I_E > I_C > I_B$

10. A BJT is in the saturation region if:
   a) Base-emitter junction is reverse-biased and base –collector junction is forward-biased.
   b) Both the junctions are reverse-biased
   c) Both the junctions are forward –biased
   d) Base-emitter junction is forward-biased and base –collector junction is reverse-biased.

11. The gate voltage in a JFET at which drain current become zero is called_____ voltage
   a) saturation
   b) Pinch-off
   c) active
   d) none of above

12. Which of the following component of FET allows charge carriers to flow from input to output?
   a) Gate
   b) Source
   c) Drain
   d) Channel

13. How many terminals does the FET transistor have?
   a) One
   b) Two
   c) Three
   d) Four

Part 2: solve any 9 questions

Q1: Calculate the ratio between the number of atoms in Silicon to the number of electron-hole pairs at room temperature.
Molecular weight :$M_{\text{Si}} = 28.09.6\ g$ density :$d_{Si} = 2.33\text{g/cm}^3$
concentration of charge carriers in pure Si = $1.48\text{x}10^{10}$ /m^3 ;
Avogadro's no.= $6.023 \times 10^{23}\ /mole$

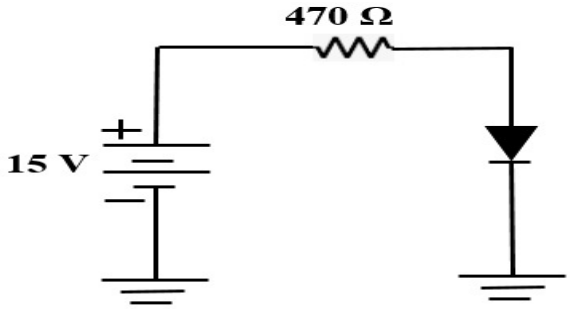
Q2:

a- Draw the Silicon diode I-V characteristic with two curves at room temperature (25 C) and at an elevated temperature (25 C + ΔT),and clearly show changes to current and diode voltage at forward and reverse direction .

b- Draw the reverse characteristic curve of a Zener diode and label on the curve : I_{ZK} , I_{ZT} , I_{ZM} , V_{ZT}.

Q**3**: Using the diode in the circuit and applying the practical model.

Determine (i) the forward voltage, (ii) the forward current,I_F ,(in mA) and (iii) voltage across the resistor ,V_R,.



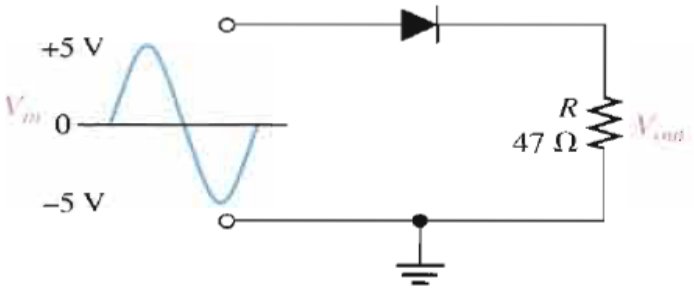
Q4: The concentration of holes in an N-type semiconductor decreases linearly from 10^{14} /cm^3 to a 10^{13} /cm^3 between the positions : x= 0 and x= 1μm .Given the formula for the diffusion current density through a semiconductor by :$J_{Dp} = - e D_p \Delta p/\Delta x$, where e =1.6x10^{-19} C ,D is diffusion constant

a- Calculate J_{Dp} if you are given that D_p=8.24 cm^2/s

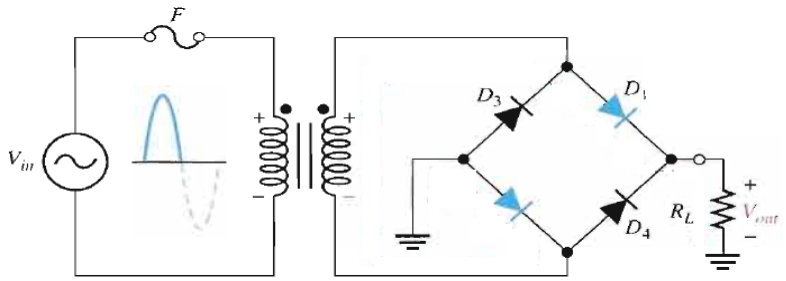
b- Write down the corresponding current density formula due to drift of holes resulting from application of electric field.

Q5.

a- Draw the output voltage waveform for the rectifier and calculate the peak forward current through the diode (include barrier potential).

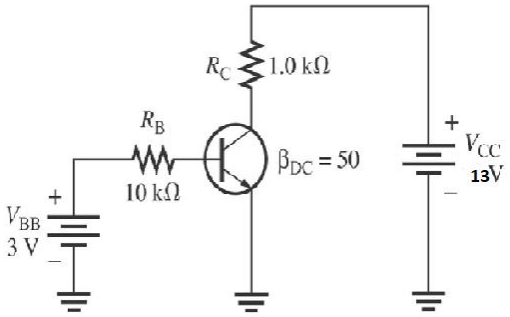


b) Given below the bridge full-wave rectifier circuit, draw arrows showing direction of the current when the input cycle is positive as shown in the figure.

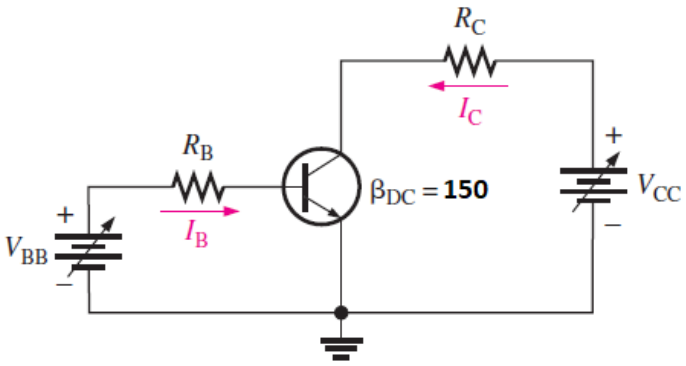


Q6. Show that, the relationship between the two coefficient α and β for a BJT is given by $\beta=\alpha/(1-\alpha)$.

Q7. Determine whether or not the transistor in Figure below is in saturation. Assume V_{CE} (sat) = 0.2 V.



Q8. Sketch an ideal family of collector curves for the circuit in Figure below for I_B = 4 μA to 20 μA in 4 μA increments. Assume β_{DC} = 150 and that V_{CE} does not exceed breakdown.



Q9. A JFET has a drain current of 5 mA. If I_{DSS} = 10 mA and V_{GS} (off) = – 6 V, find the value of (i) V_{GS} and (ii) V_P.

Q10. Draw the transfer function for P-channel JFET if you know that, I_{DSS} = 10mA and Vp=4V.