Code No: RT21041 **R13** SET - 1

II B. Tech I Semester Regular Examinations, Dec - 2015
ELECTRONIC DEVICES AND CIRCUITS
(Com. to ECE, EIE, ECC)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Define i) transient capacitance ii) Diffusion capacitance (4M)
   b) Explain Fermi level in intrinsic and extrinsic semiconductor (4M)
   c) Derive the expression for ripple factor of Half wave rectifier (4M)
   d) Write a note on punch through or reach through effect. (3M)
   e) List the advantage and disadvantages of fixed bias method (3M)
   f) Explain briefly drain characteristics of N-channel enhancement MOSFET (4M)

PART –B

2. a) Derive an expression for conductivity in a intrinsic semiconductor in terms of electron & hole concentration (8M)
   b) Find the concentration of holes & electrons in the P-type silicon at 300^0K assuming its resistivity as 0.02Ω-cm, μ_p=475cm^2/vs , η_i=1.45×10^{10}/cm^3. (8M)

3. a) Draw and explain VI characteristics of Si & Ge diode. (8M)
   b) Explain the operation of SCR & its characteristics (8M)

4 a) Write a neat diagram and explain working principle of full wave bridge rectifier (8M)
   b) List the types of filters used in rectification & compare various filter circuits in terms of ripple factors. (8M)

5. a) Draw the input & output characteristics of a NPN transistors in CB configuration & explain (8M)
   b) For a silicon, α=0.995 emitter current is 10mA & leakage current I_{C0}=0.5μA. Find I_C ,I_B ,β, and I_{CEO} (8M)
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6. a) Explain the working of collector – Base bias circuit using NPN transistor. Derive the equation for I_B (8M)

   b) For the circuit shown in Figure 1, I_C =2mA, β=100 & V_{CE}=3V. Calculate R_1& R_C. Assume V_{BE}=0.6v. (8M)

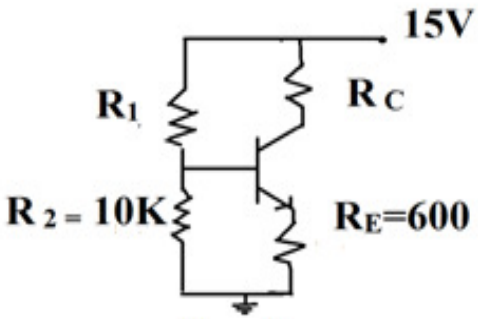

Figure 1

7. a) Draw the h-parameters equivalent circuit for a common emitter amplifier and derive the Expression for A_i ,R_I, A_v. (8M)

   b) For a common source amplifier as shown in Figure 2, operating point is defined by V_{GSQ}= -2.5V, V_P= -6V & I_{DQ}=2.5mA with I_{DSS}=8mA. Calculate g_m, r_d, Z_i, Z_o & Voltage gain Av. (8M)

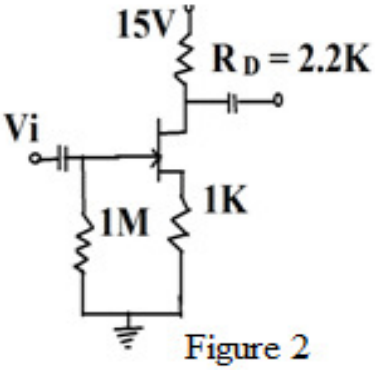

Figure 2

Code No: RT21041 **R13** SET - 2

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PART –A

1. a) Explain drift and diffusion currents in semiconductors (4M)
   b) Draw the V-I Characteristics of diode and explain (3M)
   c) Derive the expression for efficiency of full-wave bridge rectifier (4M)
   d) Explain how transistor works as an amplifier (3M)
   e) What is the need for biasing and writes the condition for biasing a transistor to work as amplifier (4M)
   f) Define h-parameter for a transistor (4M)

PART –B

2. a) Prove that Fermi level lies in the center of forbidden band for intrinsic semiconductor (8M)
   b) In a Ge PN Junction at 300^0 k have the following parameters $L_D=5x10^{18}/cm^3$, $L_A=6x10^{16}/cm^3$, $n_i=1.5x10^{10}/cm^3$. Calculate the minority electron density in p-region and minority hole density in n-region. (8M)

3. a) Draw the equivalent circuit and V-I Characteristics of UJT and explain it (8M)
   b) Design a Zener diode regulator to meet following specifications. Unregulated DC input voltage $V_i=10\pm20V$ regulated DC output $V_o=5V$. $I_{Zmin}=5mA$, $I_{Zmax}=80mA$, Load current Ic=20 mA (8M)
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4. a) Draw the circuit of a half wave rectifier and explain its working with input and output waveform (8M)

   b) A Full wave rectifier circuit is fed from a transformer having a center tapped secondary winding. The rms voltage from either end of secondary to center tap is 30 V, if diode forward resistance is 2Ω and half secondary resistance is 8Ω for a load of 1 KΩ, Calculate, i).Power delivered to load ii).% regulation iii). Efficiency iv).Ripple factor (8M)

5. a) Draw input and output characteristics of an NPN transistor in CE configuration and explain (8M)

   b) Explain the working of FET with neat diagram and relevant characteristics. Indicate each region of the characteristics. (8M)

6. a) Define stability factor and discuss the factors that cause in stability of biasing circuit (8M)

   b) Determine the operating point for a silicon transistor biased by fixed bias method with β=100, R_B=500 KΩ, Rc=2.5 KΩ and Vcc=20 V and draw DC load line (8M)

7. a) Explain the analysis of transistor amplifier circuit using h-parameter. Derive the equation for input impedance, voltage gain and output impedance (8M)

   b) The amplifier utilizes n-channel FET using source self bias circuit for which Vp=-2V, I_{DSS}=1.65 mA. It is desired to bias the circuit at I_D=0.8 mA, Av=20 dB using V_{DD}=4V. Assume rd >> RD, find i) VGs ii) gm iii) R_s iv) R_D (8M)

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2. Answer **ALL** the question in **Part-A**
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PART –A

1. a) Calculate reverse saturation current for silicon diode which passes a current of 10 mA at 27 C for a forward bias of 700mV (4M)
   b) Explain about a charge density in a semiconductor (3M)
   c) Derive an expression for TUF in Bridge rectifier? (4M)
   d) Differentiate between J-FET and MOSFET (4M)
   e) Derive the stability factor for S and S' for fixed bias circuit (4M)
   f) List the benefits of h-parameters. (3M)

PART -B

2. a) State and explain continuity equation (8M)
   b) Estimate the values of resistivity of an intrinsic germanium at 300 K. Given that intrinsic concentration=$2.5X10^{13}$ cm^3, electron mobility=3800 cm^2/vs, hole mobility=1800 cm^2/vs, electron charge=$1.6x10^{-19}$ C and also derive the expression for conductivity in a intrinsic semiconductor (8M)

3. a) Explain working of two transistor model of an SCR and Draw the SCR Characteristics (8M)
   b) Draw and explain VI Characteristics of PN Junction diode. Write current equation of PN Junction (8M)

4. a) Derive an expression for ripple factor for a full-wave rectifier with capacitor filter (8M)
   b) Explain L-section and π-section filter with diagrams (8M)

5. a) Compare three transistor Configurations (8M)
   b) Derive the relationship between α and β. Given I_E=2.5 mA, α=0.98 and I_{CBO}=10μA. Calculate I_B and I_C. (8M)

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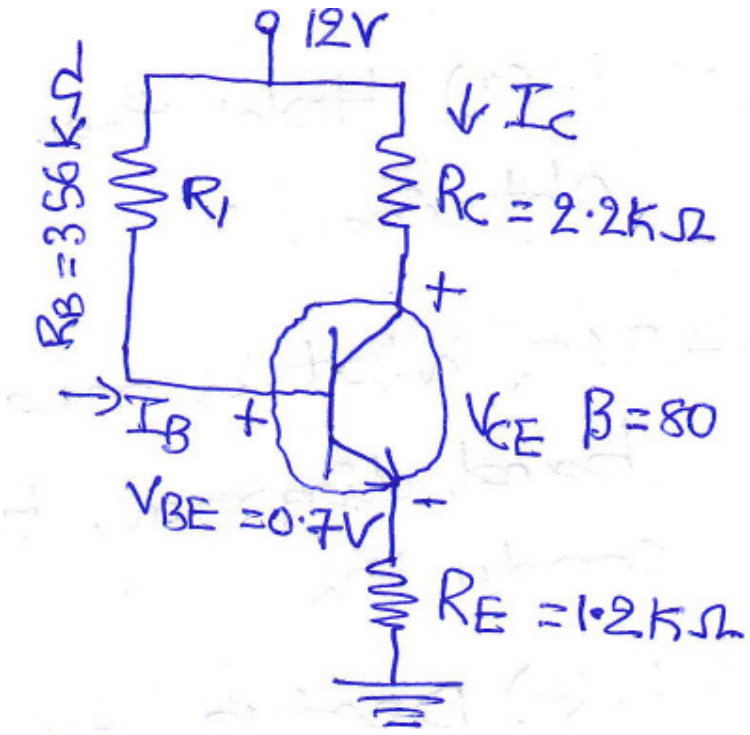
6. a) For the circuit shown in Figure 1, determine I_B, I_C, I_E, V_{CE} and stability factor S. (8M)



b) Write a short note on different biasing techniques for JFET. (8M)

7. a) Determine the h-parameters for common emitter configuration from the characteristic curves (8M)

b) Derive the expressions for Z_i, Z_o and A_v for common drain J-FET amplifier (8M)

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2. Answer **ALL** the question in **Part-A**
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1. a) Classify metals using energy band diagrams (3M)
   b) Write a note on LED (4M)
   c) Define i) Ripple factor ii) % Regulation (4M)
   d) Explain working principle of Photo transistor in brief (4M)
   e) Explain any one bias compensation method (3M)
   f) Explain the working principle of n-MOSFET (4M)

PART –B

2. a) With a neat sketch explain the phenomena of Hall Effect in semiconductors (8M)
   b) What is Fermi Dirac delta function. State its significance (8M)

3. a) Explain the construction and working of photodiode? (8M)
   b) Explain the operation of varactor diode with neat diagram (8M)

4. a) With neat diagram, explain bridge rectifier. Draw the input and output waveforms (8M)
   b) A diode whose internal resistance is 20ohms is to supply power to a load of 1 KΩ from 110 V (rms) source of supply. Calculate a). Peak load current b). DC load current c). AC load current d). DC diode voltage e). Total input power f) Peak Inverse voltage g) % of regulation h). Efficiency (8M)

5. a) Draw the drain characteristics of a n-channel JFET and Explain it. (8M)
   b) Derive an expression between transistor parameters (α, β, γ)? (8M)

6. a) Determine the level of I_{CQ} and V_{CEQ} for voltage divider configuration using exact and approximate techniques V_{cc}=18 v, R_1=82 KΩ, R_2=22KΩ , R_c=5.6KΩ, R_E=1.2KΩ , β=50 (8M)
   b) With the help of neat diagram explain the voltage divider biasing method for FET (8M)

7. a) Determine and define the h-parameters using a two port network model (8M)
   b) For common source amplifier V_{GSQ}=-2V, I_{DSS}=8mA, V_p=-8V, Y_{os}=20μs, R_G=1MΩ , R_D=5.1KΩ, calculate g_m, r_d, Z_i, Z_o and A_v (8M)

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