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

II B. Tech I Semester Regular/Supplementary Examinations, Oct/Nov - 2016
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) Draw the energy band structures of Insulators, Semi conductors and Metals (3M)
   b) Draw the Construction diagram and characteristics of the SCR (4M)
   c) Derive expression for the efficiency of a Half wave rectifier circuit (4M)
   d) Transistor works as an amplifier, justify? (4M)
   e) Draw the BJT collector to base bias circuit and derive for the stability factor 'S' (4M)
   f) Draw the small signal low frequency h-parameter model of a CE Transistor (3M)

PART -B

2. a) Derive expression for current density of an intrinsic semiconductor (8M)
   b) Show that the Fermi energy level lies in the centre of forbidden energy band for an intrinsic semiconductor? Derive. (8M)

3. a) Determine the forward resistance of a Silicon PN junction diode when the forward current is 6 m A at room temperature (8M)
   b) Draw the energy band structure of an open circuited PN junction and derive expression for the total shift in the energy level E_0 (8M)

4. a) Draw the Half-wave rectifier with relevant waveforms and derive expression for its efficiency (10M)
   b) Design LC filter for a Full-wave rectifier circuit to provide an output voltage of 10 V with a load current of 200 m A and the ripple is limited to 2%. (6M)

5. a) Draw the construction diagram, operation characteristics and parameters of JFET (8M)
   b) For the NPN transistor connected in CE configuration with V_{CC}=9 V, V_{BB}=4V, I_C = 5 m A, V_{CE}=5 V, β=50 and V_{BE}=0.7 V. Find β and R_B (8M)

6. a) Discuss the need for biasing a transistor and illustrate the DC load line analysis of BJT (8M)
   b) A p-n-p Germanium transistor is used in CE mode with self bias circuit. The circuit component values are V_{CC} = 4.5 V, R_C = 1.5 kΩ, R_e = 0.27 kΩ, R_1= 2.7 kΩ, R_2 = 27 kΩ. If β = 44, find the quiescent point. (8M)

7. a) Give the complete analysis of CE transistor amplifier circuit using h-parameters and derive expressions for the current gain, voltage gain, input impedance and output admittance (8M)
   b) Give the complete low-frequency analysis of Common Source FET amplifier (8M)

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

1. a) Compare and contrast drift and diffusion mechanisms (4M)
   b) Draw the energy band diagram of an open circuited PN junction (3M)
   c) Draw the Bridge rectifier circuit with input and output waveforms (4M)
   d) If the transistor has an α of 0.98, find the value of β and if β is 200 find α (4M)
   e) Draw the self bias circuit for BJT and derive for the stability factor 'S' (4M)
   f) Draw the small signal low frequency h-parameter model of a CB Transistor (3M)

PART -B

2. a) Elaborate how Hall effect is used to measure mobility and conductivity? Derive relevant expressions (8M)
   b) Calculate the resistivity of an intrinsic germanium at 300^0 K. Given, $n_i = 2.5x10^{13}$ per cm^3, $\mu_n = 3800\ cm^2/V\text{-}Sec.$ and $\mu_p = 1800\ cm^2/V\text{-}Sec.$. (8M)

3. a) Draw the Construction diagram, operation and characteristics of SCR (8M)
   b) Derive expression for the Transition capacitance of PN junction diode (8M)

4. a) Draw the Full-wave rectifier with center tapped transformer, draw relevant waveforms and derive expression for its efficiency. (8M)
   b) A Full-wave rectifier is connected with LC filter, derive expression for the ripple factor and draw relevant waveforms (8M)

5. a) Draw the drain characteristics of depletion mode MOSFET. Explain different operating regions. (8M)
   b) For the NPN transistor connected in CE mode with $V_{CC}=12V$, $V_{BB}=5V$, $I_C=15$ m A, $V_{CE}=5$ V, $\beta=99$, $V_{BE}=0.7$ V and $R_E=55\Omega$ Find I_B,R_B and R_C (8M)

6. a) What is the need to fix the operating point of a transistor and illustrate the complete AC load line analysis of BJT (8M)
   b) A p-n-p transistor is used in a common collector circuit with $R_C=0$. The circuit component values are $V_{CC}=3$ V, $R_e = 1k\Omega$, $R_1=R_2= 5k\Omega$. If $\beta = 44$, find the quiescent point. (8M)

7. a) Give the complete analysis of CC transistor amplifier circuit using h-parameters and derive expressions for the current gain, voltage gain, input impedance and output admittance (10M)
   b) Find the value of h_{oe} in terms of CB h-parameters (6M)

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Code No: RT21041 **R13** SET - 3

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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) State Hall effect and what are its applications (4M)
   b) The reverse saturation current of a Silicon PN junction diode is 10 µA. calculate the diode current for the forward bias voltage of 0.5V at 27^0C. (4M)
   c) Draw the Full wave rectifier circuit with input and output waveforms (3M)
   d) Draw the Ebers-Moll model of a transistor (3M)
   e) What is thermal runaway? Brief it (4M)
   f) Compare different transistor amplifiers (4M)

PART -B

2. a) A specimen of silicon has a square cross section of 3x3 mm and length of 3.5 cm, the current is due to electrons with mobility of 1300 cm^2/V-Sec. A DC voltage of 1V is impressed across the bar results 8 m amp of current. Calculate the concentration of free electrons and the drift velocity. (8M)
   b) State and explain Hall effect and derive for Hall voltage? What are the applications of Hall effect? (8M)

3. a) Compare and contrast Zener breakdown and Avalanche breakdown (8M)
   b) Draw the Construction diagram, operation and characteristics of UJT (8M)

4. a) Draw the Bridge rectifier with relevant input and output waveforms and derive expression for its efficiency (8M)
   b) A Full-wave rectifier is connected with an inexpensive capacitor filter, derive expression for the ripple factor and draw relevant waveforms (8M)

5. a) Compare and contrast JFET with MOSFET? Draw the symbols of all MOSFETs (8M)
   b) The NPN transistor has α=0.98, I_{CO}=1.6µA. This transistor is used in CE configuration with V_{CC}=12V and R_L=6KΩ. Calculate the minimum base current required for the transistor to enter into saturation (8M)

6. a) Draw the self bias circuit with BJT and derive expressions for all the three stability factors (8M)
   b) Assume a Silicon transistor with self bias arrangement. Given that β=50, $V_{BE\ active}$ =0.7, V_{CC} = 22.5 V, and R_C = 5.6 k Ω. It is desired to establish the Q-point at V_{CE} = 12 V, I_C = 1.5 m A, and stability factor S ≤ 3. Find R_E, R_1 and R_2 (8M)

7. a) The CE transistor amplifier circuit has the following specifications: h_{ie} = 1100Ω, h_{re} = 2.5 x 10^{-4}, h_{fe} = 50, h_{oe} = 24 µA/V. If R_L = 10 k Ω and R_S = 1 k Ω , Find various gains and input, output impedances (10M)
   b) Find the value of h_{re} in terms of CB h-parameters (6M)

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Code No: RT21041 **R13** SET - 4

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Time: 3 hours Max. Marks: 70

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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) Relate conductivity with current density in a semiconductor (4M)
   b) Draw the Construction diagram and characteristics of the Photo diode (4M)
   c) Compare various filter circuits in terms of ripple factors used with rectifier circuits (4M)
   d) Compare JFET and MOSFET (4M)
   e) A FET has a drain current of 4 mA, if I_{DSS} is 10 mA and V_P is - 6V. Find the value of Gate to Source voltage (3M)
   f) Draw the small signal model of FET (3M)

PART -B

2. a) In a P-type semiconductor, the Fermi level is 0.35 e V above the valance band at room temperature. Determine the new position of the Fermi level for temperatures of 350^0K and 400^0K (8M)
   b) Derive expression for the continuity equation (8M)

3. a) What is a Tunnel diode? Explain the construction and working with neat band diagrams? Draw its characteristics (8M)
   b) Calculate the dc and dynamic ac resistances of a Silicon diode at 300^0K with I_0=2.5 μA and at an applied voltage of 0.25 V across the diode (8M)

4. a) Define transformer utilization factor and derive its expression for i) Half wave rectifier ii) Full wave rectifier. (8M)
   b) A Full-wave rectifier is connected with an inductor filter, derive expression for the ripple factor and draw relevant waveforms (8M)

5. a) From the transistor current components, deduce the current equation of transistor (8M)
   b) Calculate the values of I_D and g_m for V_{GS} = -0.8V, if I_{DSS} and V_P are given as 12.(4M)A and -6V respectively. (8M)

6. a) The CE transistor uses a Collector to Base bias circuit has V_{CC}=12V, R_C=2 kΩ and R_B = 100 kΩ. Calculate quiescent point and stability factor 'S' (8M)
   b) What is thermal runaway? Derive relevant expressions to obtain thermal stability (8M)

7. a) From the low-frequency small signal FET model, derive for the FET parameters (8M)
   b) The CC transistor amplifier circuit has the following specifications: (8M)
   h_{ic} = 1100Ω, h_{rc} = 0.99, h_{fc} = -51, h_{oc} = 25 μA/V. If R_L = 15 k Ω and R_S = 1 k Ω , Find various gains and input, output impedances

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