(b) Draw and explain the following :
   (i) Precision rectifier.
   (ii) Integrator.
   (iii) Active low pass filter. (9)

6. (a) Draw and explain the circuit diagram of square wave generator with proper waveforms using operational amplifier. Also find the time period of generated wave. (8)
   (b) Explain the diagram of hysteretic comparator and zero crossing detector with their waveforms. (7)

7. Write short notes on the following :
   (i) Analog to digital converter.
   (ii) Multistage amplifier.
   (iii) Voltage regulator. (15)

011301

December 2023

B.Tech. (IT/CE(Hindi Medium)/CE/CSE/CSE(AIML))

III SEMESTER

Analog Electronics Circuits (ESC-301)

Time : 3 Hours]   [Max. Marks : 75

Instructions :
1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

PART–A

1. (a) If the dc output voltage of a center tap full wave rectifier and bridge rectifier is 50 V. Calculate the peak inverse voltage in both cases. Assume diode is ideal. (1.5)
   (b) Define α and β, also find relationship between α and β. (1.5)
   (c) Which transistor parameters vary with temperature? (1.5)
   (d) Why is a FET known as a unipolar device? (1.5)

(e) The differential voltage gain and CMRR of an operational amplifier when expressed in decibels are 110 dB and 100 dB respectively. Calculate the common mode gain. (1.5)

(f) Explain the Barkhausean criteria for oscillations. (1.5)

(g) Write down characteristics of an ideal operational amplifier. (1.5)

(h) Differentiate between active and passive filters. (1.5)

(i) Three R-C sections are used in RC phase shift oscillators, Why? (1.5)

(j) Differentiate between Class A and Class B power amplifier. (1.5)

PART–B

2. (a) Draw the circuit diagram of bridge rectifier. Explain its working with proper waveforms. Derive the expression for (i) average dc output current (ii) rms output current (iii) ripple factor (iv) rectification efficiency (v) Peak inverse voltage. (7)

(b) Draw the output waveforms for given circuits. Assume diode is ideal. (8)
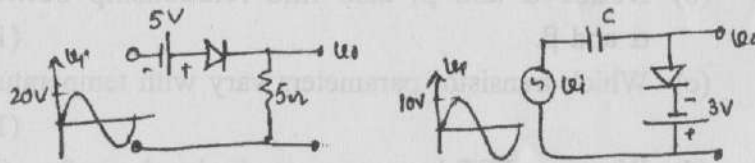
3. (a) Draw the output characteristics of common base configuration and explain active, saturation and cut off regions in this output characteristics. (5)

(b) A Common emitter amplifier uses voltage source having internal resistance $R_s = 800\ \Omega$ and load resistance $R_L = 1000\ \Omega$. The h parameters are $h_{ie} = 1\ k\Omega$, $h_{re} = 2\times10^{-4}$, $h_{fe} = 50$, $h_{oe} = 25\ \mu A/V$. Calculate current gain A_i, Input impedance Z_i and Voltage gain A_v. (6)

(c) A transistor is connected in CE configuration with a collector supply of 9 V, the voltage drop across R_C connected between collector and supply is 5 V. The value of resistance R_C is 500 ohms. Calculate base current with $\alpha = 0.96$, given $I_{CBO} = 1\ \mu A$. (4)

4. (a) A NPN transistor circuit uses the voltage divider method of biasing has $\alpha = 0.985$ and $V_{BE} = 0.3$ V, if $V_{CC} = 15$ V, Calculate R_1 and R_C to place Q point at $I_C = 2$ mA and $V_{CE} = 4$ V. The value of $R_E = 2\ k\Omega$ and $R_2 = 20\ k\Omega$. (9)

(b) Draw the structure of N-channel FET and explain its operation. Also draw its V-I characteristics. Define pinch off voltage and show it on the V-I characteristics. (6)

5. (a) Draw the circuit diagram of wein bridge oscillator using operational amplifier. Explain its operation and find the frequency of oscillations. (6)