masterranjeet.com

Code : 100302

B.Tech 3rd Semester Exam., 2020
(New Course)

ANALOG ELECTRONIC CIRCUITS

Time : 3 hours *Full Marks* : 70

Instructions :

(i) The marks are indicated in the right-hand margin.

*(ii) There are **NINE** questions in this paper.*

*(iii) Attempt **FIVE** questions in all.*

*(iv) Question No. **1** is compulsory.*

(v) Symbols and notations carry their usual meanings.

1. Answer any *seven* questions of the following : 2×7=14

(a) What is the function of clamping circuits?

(b) Explain diode positive shunt clipper circuit with waveforms.

(c) Write the important characteristics of common source configuration of JFET.

(d) Explain the half-wave rectifier with suitable diagram.

(e) What is integrator circuit?

(f) Write down the three differences between BJT and JFET.

(g) Explain the important characteristics of Darlington emitter-follower.

(h) What is precision rectifier circuit?

(i) What are the advantages of *h*-parameters?

Answer any *four* questions. Attempt any *two* parts from each :

2. (a) Derive the expression for stability factor for fix bias circuit with respect to I_{CO}, V_{BE} and β.

(b) State and prove Miller's theorem.

(c) A voltage divider biased circuit has $R_1 = 39\,k\Omega$, $R_2 = 82\,k\Omega$, $R_C = 3{\cdot}3\,k\Omega$, $R_E = 1\,k\Omega$ and $CC = 18V$. The silicon transistor has used $\beta = 120$. Find *Q*-point and stability factor. 7×2=14

3. *(a)* An op-amp has gain bandwidth product of 15 MHz. Determine the bandwidth of op-amp when $A_{CL} = 500$. Also, find the maximum value of A_{CL} when frequency is 200 KHz.

(b) What are the advantages and features of instrumentation amplifier? Derive the expression for output voltage of instrumentation amplifier.

(c) The data sheet of *N*-channel JFET gives the following details :

$I_{DSS} = 9\text{mA}$ and pinch-off voltage = –4·5V

(i) At what value of V_{GS} will I_D be equal to 3 mA?

(ii) What is its g_m at this I_D? 7×2=14

4. *(a)* Derive an expression for input impedance voltage gain, current gain and output impedance for an emitter-follower circuit using *h*-parameter model for the transistor.

(b) Explain the need of cascading amplifier. Draw and explain the block diagram of two-stage cascade amplifier.

(c) Derive an expression for frequency of oscillators in Wien bridge oscillator.

7×2=14

5. *(a)* Explain the principle of operation of oscillator and effect of loop gain ($A\beta$) on the output of oscillator.

(b) With the help of neat diagram, explain the construction working and characteristics of *N*-channel depletion-type MOSFET.

(c) A given amplifier arrangement has the following voltage gains :

$A_{v1} = 10$, $A_{v2} = 20$ and $A_{v3} = 40$

Calculate the overall voltage gain and determine the total voltage gain in dB.

7×2=14

6. *(a)* Determine Z_{in}, Z_{out} and A_v for JFET common source amplifier with fixed bias configuration using AC equivalent small signal model.

(b) With the help of neat diagram, explain the construction working and characteristics of *N*-channel JFET.

(c) Explain the law frequency response of single-stage RC-coupled amplifier. 7×2=14

7. *(a)* Obtain an *h*-parameter equivalent circuit of CB and CE configurations.

(b) With the help of block diagram, explain the concept of feedback.

(c) Discuss with the help of circuit example, the purpose of providing—

(i) negative feedback;

(ii) positive feedback in amplifier. 7×2=14

8. *(a)* Draw the high frequency equivalent circuit of an emitter follower and derive the expression of upper cut-off frequency f_H.

(b) Transistor's short circuit current gain is measured to be 25 at a frequency of 2 MHz. If $f_B = 200$ kHz, calculate the following :

(i) The current gain bandwidth product

(ii) h_{fe} at low frequency

(iii) Short circuit current gain at 10 MHz and 100 MHz

(c) A phase-shift oscillator uses three identical *R-C* sections in feedback network. The value of components are $R = 100\ \text{k}\Omega$ and $C = 0{\cdot}01\mu\text{F}$. Calculate the frequency of oscillator. 7×2=14

9. *(a)* An amplifier has a voltage gain of 40. The amplifier is now modified to provide a 10% negative feedback in series with the input. Determine the following :

(i) Voltage gain with feedback

(ii) Amount of feedback in dB

(iii) Loop gain

(b) Write the important advantage of a negative feedback amplifier and show that how bandwidth of an amplifier increases with negative feedback.

(c) What is transistor biasing? Explain emitter bias circuit with relevant circuit and equations. 7×2=14

★★★