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December 2024

B. Tech. (Third Semester)

Analog Electronic Circuit (ESC-301)

Time : 3 Hours] [*Maximum Marks : 75*

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

Part A

1. (a) What is the meaning of PIV for PN junction diode ?

   (b) What is the meaning of ripple factor of a rectifier ?

   (c) What is the use of practical analog to digital convertors ?

   (d) Why BJT are called so ?

   (e) Draw the large signal model of MOSFET.

   (f) What is the difference between open loop configuration and closed loop configuration of OP AMP ?

(g) Plot I-V characteristics of MOSFET.

(h) How does the slew rate impact the performance of high-speed amplifiers ?

(i) Explain the concept of a BJT current mirror.

(j) Draw the circuit of the zero crossing detector using OP-AMP.

Part B

2. (a) For a full-wave rectifier circuit with a transformer secondary of 12V RMS and a 1000 uF capacitor, calculate the DC output voltage and ripple factor for a 1k load.

(b) Explain the working principle of a Zener diode and describe how it can be used as a voltage regulator. What are the conditions for proper operation ?

3. (a) Compare and contrast the common-emitter, common-base, and common-collector configurations in terms of voltage gain, current gain, and input/output impedance.

(b) Describe the structure and I-V characteristics of a MOSFET. How is it different from a BJT in terms of Construction, operation and application ?

4. (a) Why biasing a circuit is required for BJT based circuits ? Calculate the base current and collector current for a BJT, which is used as a switch in a circuit with a supply voltage of 10V ? The collector resistor is 1kΩ and the base resistor is 100Ω. The BJT has a current gain h_{fE}=100.

(b) Derive the expression for output impedance and voltage gain of a Common Source FET Amplifier.

5. (a) Differentiate between an ideal OP-AMP and practical OP-AMP ? Describe the working principle of a peak detector using an op-amp and a diode. What are the key parameters that affect its performance ?

(b) Explain the working of a differential amplifier and discuss its significance in analog circuits. How does the common-mode rejection ratio (CMRR) affect its performance ?

6. (a) Explain the operation of a precision rectifier. How does it differ from a conventional rectifier, and why is it important in signal processing ?

(b) Design a square-wave generator using an op-amp. Also for a frequency of 1kHz and a feedback resistor of 10kΩ, calculate the timing capacitor required.

7. (a) Explain the operation of an instrumentation amplifier and its applications. Why are instrumentation amplifiers preferred for precise and low-noise signal measurement ?

(b) Discuss the operation of a square wave and triangular wave generator circuit using an op-amp.