F 3147 (Pages : 4) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Third Semester

Branch : Applied Electronics and Instrumentation Engineering/Electronics and Communication Engineering

AI 010 305/EC 010 305—ANALOG CIRCUITS—I (AI, EC)

[New Scheme—2010 Admission onwards]

(Regular/Improvement/Supplementary)

Time : Three Hours Maximum : 100 Marks

Part A

Answer **all** *questions briefly.*
Each question carries 3 *marks.*

1. Draw the circuit of a RC integrator and show how it can function as a low pass filter.
2. Compare the input resistances of CE, CC and CB configurations, giving their typical values.
3. What is meant by gate-to-source threshold voltage in E-MOSFET ?
4. If $h_{fb} = 0.978$ and $f_\alpha = 2.5$ MHz for a transistor, determine its f_β and β at the same frequency.
5. Compare the efficiencies of class A, B and AB power amplifiers.

(5 × 3 = 15 marks)

Part B

Answer **all** *questions.*
Each question carries 5 *marks.*

6. Draw a clipping circuit for limiting the output at ± 5V. Design your circuit.
7. Define the three stability factor of a common-Emitter amplifier circuit. Why the current stability factor alone is given more consideration among the three factors, while designing the circuit ?
8. An *n*-channel E-MOSFET has the following parameters : $I_{D(ON)} = 5mA$ at $V_{GS} = 8$ volt and $V_{GST} = 4$ volt. Calculate the drain current when $V_{GS} = 6$ volt.
9. Draw the high frequency hybrid π equivalent circuit for a common-Emitter transistor and define the parameters of the circuit.
10. Derive the expression for A_f, the gain with feedback in a negative feedback amplifier and show that A_f is stabilised against the active device parameter changes.

(5 × 5 = 25 marks)

Turn over

Part C

Answer **all** *questions.*
Each full question carries 12 *marks.*

11. Draw the complete circuit diagram of a bridge rectifier with π filter and explain the working, with necessary waveforms. Derive expression of the ripple factor of this circuit.

Or

12. A centre-tapped full wave rectifier with capacitor filter is supplying a resistive load of 250 Ω. The filter capacitor is 40 μF and the transformer secondary voltage is 35 volt r.m.s. to centre-tap at a frequency of 50 Hz. Assuming ideal diodes and neglecting transformer losses, calculate :

    (a) Ripple factor.

    (b) Output resistance of the filter.

    (c) d.c. output voltage.

    (d) d.c. load current.

    (e) Percentage load regulation ; and

    (f) Turns ratio of the transformer, assuming 230 volt, 50 Hz a.c. mains input at the primary.

(6 × 2 = 12 marks)

13. Draw the hybrid parameter equivalent circuits for the CE and CC configurations.

    (a) Subject to the restriction that $R_L = 0$. Then show that the input resistances of the two circuits are identical.

    (b) Subject to the restriction that the input is open-circuited. Then show that the output resistances of the two circuits are identical.

(6 + 6 = 12 marks)

Or

14. A transistor connected as a common-emitter amplifier is driving a load of 10 K. It is supplied by a signal source of 1 K internal resistance. The hybrid parameters of the transistor are $h_{ie} = 1100\ \Omega$, $h_{re} = 2.5 \times 10^{-4}$, $h_{fe} = 50$, $h_{oe} = \frac{1}{40\ k\Omega}$. Calculate the :

    (a) Current gain.

    (b) Voltage gain.

    (c) Input resistance ; and

    (d) Output resistance.

(4 + 4 + 2 + 2 = 12 marks)

15. With a neat circuit diagram and its equivalent circuit, derive the expressions for the voltage gain, input and output impedances of a sources follower amplifier.

Or

16. The following MOSFET circuit Fig. 1 has threshold voltage of +2 volt, drain current of 8 mA at a gate-source voltage of 6 volt.

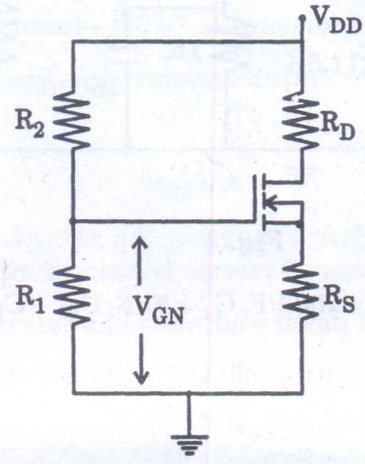

Fig. 1

(a) Calculate the drain current for a quiescent point defined by V_{GS} = 4 Volt and V_{DS} = 10 volt.

(b) Design the bias circuit for V_{DD} = 24 volt, given R_1 = 1 MΩ. Obtain R_2, R_D and R_S. Assume V_{GN} = 12 volt.

17. Draw the high frequency equivalent circuit for a CS, MOSFET amplifier and derive expressions for its voltage gain and upper cut-off frequency.

Or

18. For the following circuit Fig. 2 (on page 4) calculate :

(a) The d.c. bias values I_{CQ} and V_{CEQ}.

(b) Mid-frequency voltage gain.

(c) Low-frequency cut-off ; and

(d) High-frequency cut-off.

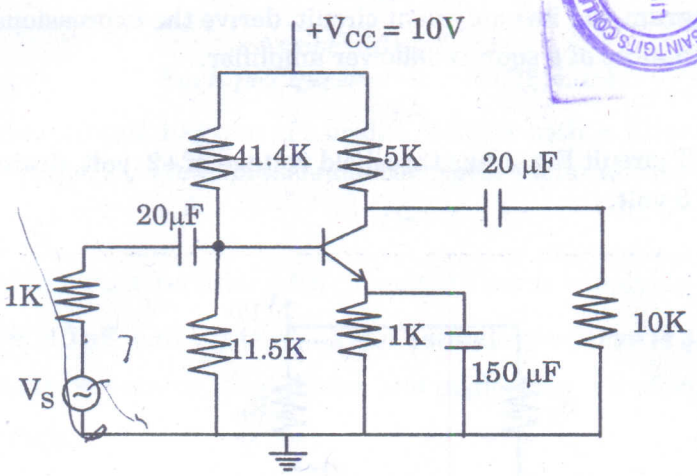

Fig. 2

Take : $\beta = 50$, $C_\pi = 100$ PF, $C_\mu = 5$PF, $C_W + C_L = 5$PF

19. Identify the type of feedback in an emitter follower amplifier circuit. Analyse the circuit to derive its gain and input resistance with feedback.

Or

20. In the ideal power amplifier shown below (fig. 3) the input is sinusoidal. Calculate

    (a) The minimum signal output power, the corresponding collector dissipation and conversion efficiency.

    (b) The maximum dissipation of each transistor and the corresponding conversion efficiency.

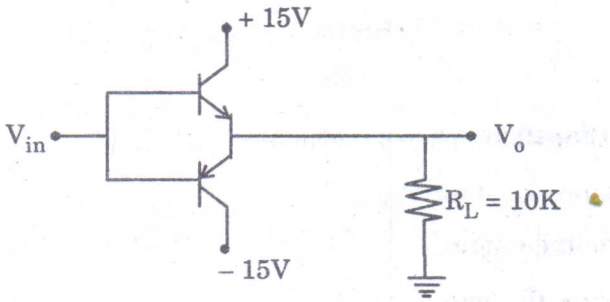

Fig. 3

(6 + 6 = 12 marks)

[5 × 12 = 60 marks]