[57/A14]

Seat No :_____

SARDAR PATEL UNIVERSITY   No. of Printed Pages : 2

Fifth (Vth) Semester (CBCS) B. Sc. Examination

Wednesday, 20th November 2019

Time: 10:00 A.M. To 01:00 P. M.

Subject: PHYSICS [US05CPHY05]

ANALOG DEVICES AND CIRCUITS

Total Marks: :

Note: All the symbols have their usual meanings.

Q-1   To answer the MCQs choose the correct option.   [10]

(1)   The expression of drain current obtained using transconductance curve of JFET is given by _____.

(a) $I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_{GS(off)}}\right)^2$

(b) $I_D = I_{DSS}\left(1 - \frac{V_{GS}}{V_{GS(off)}}\right)$

(c) $I_D = I_{DSS}\left(1 - \frac{V_{GS(off)}}{V_{GS}}\right)^2$

(d) $I_D = I_{DSS}\left(1 - \frac{V_{GS(off)}}{V_{GS}}\right)$

(2)   N-channel JFET has pinch-off voltage $V_p = 6V$ and $I_{DSS} = 10mA$. What will be its ohmic resistance R_{DS}?

(a) 600Ω (b) 0.6 Ω (c) 60 Ω (d) 6000 Ω

(3)   The inversion layer is created in _____ device.

(a) D-MOSFET   (b) E-MOSFET

(c) N type JFET   (d) P type JFET

(4)   In a small signal transistor amplifier voltage gain decreases in the high frequency range due to _____.

(a) reactance of coupling capacitor

(b) reactance of interelectrode capacitors

(c) reactance of bypass capacitor

(d) reactances of coupling capacitor and bypass capacitor

(5)   The frequency at which CE short circuit high frequency current gain drops 3dB from its value at 1KHz is denoted by_____.

(a) f_α (b) f_T (c) f_β (d) f_{hfb}

(6)   The input centre tap transformer in push pull amplifier provides _____.

(a) two signals of same magnitude and opposite phase

(b) two signals of same magnitude and same phase

(c) two signals of unequal magnitude and opposite phase

(d) two signals of unequal magnitude and same phase

(7)   To operate the transistor in class A condition the operating point is set ____.

(a) in the cutoff region   (b) at the center of the output characteristics

(c) in the saturation region   (d) beyond the cutoff region

(8)   In a certain operational amplifier (opamp), the output voltage rises 3 V in 6 μs, its slew rate will be _____.

(a) 2.0 μs/V (b) 4.0 V/μs (c) 0.5 V/μs (d) 2.0 V/μs

(9)   To use the non-inverting opamp as a voltage follower the feedback resistor is replaced by_____.

(a) transistor (b) diode (c) capacitor (d) short circuit

(10)   The common mode rejection ratio is defined as_____.

(a) A_c/A_d (b) A_d/A_c (c) A_d-A_c (d) $(A_d$-$A_c)/A_d$

(PTO)

Q-2 Answer briefly **Any Ten** of the following questions. [20]
- **(1)** Explain briefly working of JFET chopper.
- **(2)** Explain briefly working of JFET multiplexer.
- **(3)** Give the construction of D-MOSFET.
- **(4)** What are the functions of coupling capacitors in a transistor amplifier?
- **(5)** For a CE transistor amplifier, if h_{fe}= 100 and f_β= 300 MHz, then calculate its gain bandwidth product (f_T).
- **(6)** What is tuned amplifier? Give the classification of small signal transistor tuned amplifiers.
- **(7)** What is harmonic distortion? How it can be minimized?
- **(8)** State the drawbacks of transistor phase inverter circuit.
- **(9)** What is cross over distortion in class B push pull amplifier?
- **(10)** What is the use of universal balancing technique?
- **(11)** State the characteristics of an ideal operational amplifier.
- **(12)** Explain the meaning of inverting and non inverting mode of opamp. What is the expression of gain in both the cases?

Q-3 **(a)** Discuss drain curve and its different regions for n-channel JFET. [06]
(b) Discuss the application of JFET in Automatic Gain Control (AGC). [04]

OR

Q-3 **(a)** Describe construction and working of Enhancement mode MOSFET with suitable diagrams. Also explain its drain curves. [06]
(b) Discuss the application of JFET as an analog series and shunt switch. [04]

Q-4 **(a)** Taking one of the terminal of the transistor common, describe the method to obtain h-parameters of a transistor using equivalent circuit. [06]
(b) With the help of hybrid equivalent circuit of transistor amplifier derive the following equations. [04]

$$(i) \quad A_i = -\frac{h_f}{1+h_o R_L} \quad and \ (ii)) \ R_i = h_i + h_r A_i R_L$$

OR

Q-4 **(a)** What is the function of emitter bypass capacitor in a transistor amplifier? Discuss its effect on low frequency gain of a transistor amplifier with necessary derivation. [06]
(b) Draw a high frequency model for the CE transistor amplifier and explain following terms (i) hybrid π capacitances and (ii) base spreading resistances. [04]

Q-5 **(a)** Describe the working of class A push pull amplifier and obtain the expression of its output current. What is the main advantage of push pull action of this circuit? [06]
(b) Give the output characteristics of class A transformer coupled resistive load amplifier and show that its maximum achievable efficiency is only 50%. [04]

OR

Q-5 **(a)** What is class B condition of an amplifier? With necessary diagram show that maximum achievable efficiency in class B condition of push pull amplifier is 78.5%. [06]
(b) With suitable circuit diagram explain the working of class B complimentary symmetry amplifier and show how it eliminates input and output transformers in push pull amplifier. [04]

Q-6 Explain AC analysis of differential amplifier and obtain the expression for (i) differential gain (ii) common mode gain (iii) common mode rejection ratio. [10]

OR

Q-6 Obtain the expression for voltage gain in an inverting mode of ideal operational amplifier. Using the same mode of operation explain its applications as (i) summing amplifier and (ii) integrator. [10]

—✕—
②