[100]

SARDAR PATEL UNIVERSITY
Fifth Semester B. Sc. Examination
Wednesday, 30th December-2020
Time: 02:00 pm To 04:00 pm
Subject: PHYSICS [US05CPHY05]
Analog Devices and Circuits

Total Marks: 70

Note: All the symbols have their usual meanings.

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

(1) A JFET _____.
(a) is a current control device (b) is a voltage control device
(c) has a low input resistance (d) has a very large voltage gain

(2) The inversion layer is created in _____ device.
(a) D-MOSFET   (b) E-MOSFET
(c) N type JFET   (d) P type JFET

(3) The voltage that turns on an EMOS device is the _____.
(a) pinchoff voltage   (b) threshold voltage
(c) knee voltage   (d) gate source cutoff voltage

(4) In a small signal transistor amplifier voltage gain decreases in the higher frequency range due to_____.
(a) reactance of coupling capacitor (b) emitter resistor
(c) reactance of bypass capacitor (d) reactance of interelectrode capacitors

(5) If base spreading resistance $r_{bb'}$ = 200 ohm and $r_{b'e}$ = 800 ohm then h_{ie} = _____ohm.
(a) 1000 (b) 700 (c) 850 (d) 150

(6) The maximum achievable efficiency of a class A transformer coupled resistive load amplifier is _____.
(a) 72.5% (b) 78.5% (c) 50% (d) 60%.

(7) In the class B condition of the power amplifier the output current flows for_____.
(a) less than half cycle of the input signal (b) half cycle of the input signal
(c) one and half cycle of the input signal (d) full cycle of the input signal

(8) The operational amplifier (opamp) is a high gain _____ coupled amplifier.
(a) inductor (b) transformer (c) capacitor (d) direct

(9) In an inverting opamp, input resistor R_i is 1KΩ and feedback resistor R_f is 10KΩ. Its magnitude of closed loop voltage gain is_____.
(a) 1000 (b) 100 (c) 10 (d)1

(10) To use the inverting opamp as a logarithmic amplifier feedback resistor is replaced by_____.
(a) capacitor (b) diode (c) short circuit (d) transistor

Que.-2 Do as directed. [08]

(A) Mention whether the following statements are True or False.

(1) N-channel JFET has pinch-off voltage V_p = 6V. Its gate source cutoff voltage $V_{GS(off)}$ will be -6V.

(2) For a CE transistor amplifier gain bandwidth product is given by $f_T = h_{fe} f_\beta$

(3) To operate the transistor power amplifier in class A condition the operating point is set at cutoff.

(4) To use the non-inverting opamp as a voltage follower the feedback resistor is replaced by capacitor.

(B) Fill in the blanks.

(5) The transconductance of JFET is the ratio of _____.

(6) f_T is the frequency at which CE short circuit current gain of transistor amplifier drops to _____.

(7) The Conversion efficiency of a power amplifier is the ratio of _____.

(8) The common mode rejection ratio is defined as _____.

Q-3   Answer briefly <u>Any Ten</u> of the following questions.   **[20]**

(1) Give the construction of n channel JFET.

(2) A JFET has $V_{GS(OFF)}$ = -6 V and I_{DSS} = 8 mA. What are the gate voltage and drain current at the half cutoff point?

(3) Explain briefly working of JFET chopper.

(4) What is the function of coupling capacitor in a transistor amplifier?

(5) Define α cutoff and β cutoff frequencies in transistor amplifier.

(6) Give the hybrid π circuit diagram of transistor amplifier with shorted load.

(7) Draw the circuit diagram of class B complimentary symmetry amplifier.

(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 in opamp?

(11) Define (i) output offset voltage and (ii) input offset voltage of opamp

(12) Define (i) input bias current and (ii) input offset current of opamp.

Que.-4   Answer the following questions in detail. (Attempt any Four)   **[32]**

(1)   Give the construction of n-channel JFET and explain its drain curves with necessary diagrams.

(2)   Describe construction and working of Enhancement mode MOSFET with suitable diagrams.

(3)   Describe the procedure to obtain h-parameters of a transistor using equivalent circuit. Also discuss the graphical method to obtain h-parameters.

(4)   Explain the function of emitter bypass capacitor in a transistor amplifier and discuss its effect on low frequency response of a transistor amplifier with the help of necessary derivation.

(5)   What is class A condition of a power amplifier? Describe the working of class A push pull amplifier and show that its output is free from even harmonics.

(6)   What is class B condition of a power amplifier? With necessary diagram show that maximum achievable efficiency in class B condition of push pull amplifier is 78.5%.

(7)   Give the circuit diagram of dual input balanced output configuration of differential amplifiers and discuss its D. C. analysis.

(8)   State the characteristics of an ideal opamp. Obtain the expression for voltage gain in inverting mode of an ideal opamp.

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