

Sardar Patel University

[43/A-17]

Vallabh Vidyanagar - 388120

BSc [Semester-V]

Subject Physics Course Code No: US05CPHY05

CBCS (Regular and NC All)

Subject: Physics

Title of the Paper: Analog Devices and Circuits

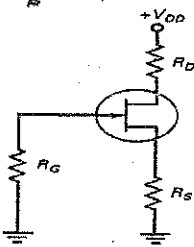
Wednesday, Date 15-11-2017

Time: 10.00 am to 01.00 pm

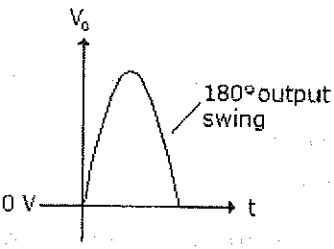
Total Marks-70

Q-1 Multiple Choice Questions: [Attempt all]**10**

- (1) A JFET has $I_{DSS} = 10 \text{ mA}$ and $V_P = 4 \text{ V}$, then $V_{GS(off)} =$ _____.
 (a) 4 V (b) -4 V (c) 40 V (d) -40 V
- (2) A JFET has $I_{DSS} = 10 \text{ mA}$ and $V_P = 4 \text{ V}$, then $R_{DS} =$ _____.
 (a) 400Ω (b) 500Ω (c) 600Ω (d) 700Ω

- (3)  This circuit diagram shows _____ of FET.
 (a) Gate bias
 (b) voltage divider bias
 (c) Two supply source bias
 (d) Self bias

- (4) The correct sentence is
 (a) For CE configuration, h_{fe} is always negative and h_{ie} is always positive.
 (b) For CE configuration, h_{ie} is always negative and h_{fe} is always positive.
 (c) For CE configuration, h_{ie} and h_{fe} both are always positive.
 (d) For CE configuration, h_{ie} and h_{fe} both are always negative.
- (5) The lower cut off frequency of the CE transistor amplifier (f_1) will be the highest if we select $C_e =$ _____ μF .
 (a) 10 (b) 20 (c) 30 (d) 40
- (6) If $r_{bb'} = 800 \Omega$ and $r_{b'e} = 200 \Omega$ then according to hybrid π -model to study the high frequency response of CE amplifier $h_{ie} =$ _____ Ω
 (a) 700 (b) 800 (c) 900 (d) 1000

- (7)  This is an example of the output swing for a _____ push pull amplifier.

- (a) Class A (b) Class B (c) Class C (d) Class AB

- (8) In _____ push pull power amplifiers, the output signal varies for a full 360° of the cycle.
 (a) Class A (b) Class B (c) Class C (d) Class AB
- (9) For ~~the~~^{an} ideal inverting amplifier using OpAmp given that $R_1=2K\Omega$ and $R_f=20K\Omega$. Voltage gain of the OpAmp is _____.
 (a) 10 (b) -10 (c) 11 (d) -11
- (10) For ~~the~~^{an} ideal non-inverting amplifier using OpAmp given that $R_1=2K\Omega$ and $R_f=20K\Omega$. Voltage gain of the OpAmp is _____.
 (a) 10 (b) -10 (c) 11 (d) -11

Q-2 Answer any TEN questions in short.

20

- (1) Draw schematic symbols of (i) n-channel JFET and (ii) p-channel JFET.
- (2) Compare construction of the depletion-mode MOSFET and the enhancement-mode MOSFET.
- (3) What are the advantages of JFET compared to a BJT?
- (4) What are the factors on which high frequency response of transistor amplifier depend?
- (5) What is the difference between ordinary amplifier and tuned amplifier? Discuss classification of small signal tuned amplifier.
- (6) Discuss the effect of an emitter bypass capacitor on low frequency response of transistor amplifier.
- (7) What is the main drawback of class B amplifier? How it is going to overcome using class AB push pull amplifier?
- (8) Define conversion efficiency of an amplifier. What is the maximum conversion efficiency of class B push pull amplifier?
- (9) What is complementary symmetry?
- (10) Why an Op-amp is called as operational amplifier? Draw the schematic symbol for Op-amp.
- (11) Calculate the output voltage of an OpAmp inverting adder for the following sets of input voltages and resistors. In all cases $R_f = 500\text{ k}\Omega$
 $V_1=3\text{ V}$, $V_2= 1\text{ V}$, $R_1 = 250\text{ k}\Omega$ and $R_2 = 500\text{ k}\Omega$.
- (12) Draw the diagram of integrator and differentiator using OpAmp.

- Q-3 (a)** Draw and discuss the drain curves and transconductance curves of JFET. **7**
- (b)** Define transconductance of FET. Calculate transconductance of the FET in the following cases: **3**
- (i) If $i_d = 0.2 \text{ mA pp}$ when $v_{gs} = 0.1 \text{ V pp}$ and
- (ii) If $i_d = 1 \text{ mA pp}$ when $v_{gs} = 0.1 \text{ V pp}$.
- Comment on the result.

OR

- Q-3 (a)** Discuss two types of JFET analog switch. **7**
- (b)** Draw the circuit diagram of current-source biasing of JFET and describe it. **3**
- Q-4 (a)** Derive the following amplifier equations: **7**
- (1) Current gain $A_i = \frac{-h_f}{1+h_o R_L}$ (2) Input resistance $R_i = h_i + h_r A_i R_L$
- (3) Voltage gain $A_v = \frac{A_i R_L}{R_i}$
- (b)** Discuss effect of coupling capacitor on low-frequency response of CE transistor amplifier. **3**

OR

- Q-4 (a)** Discuss high frequency response of CE transistor amplifier. Draw diagram, which shows (i) α cut of frequency (ii) β cut off frequency and (iii) gain bandwidth product (f_T). **7**
- (b)** List four h-parameters. Define and explain any one. **3**
- Q-5 (a)** Write a note on harmonic distortion. How even harmonics is eliminated using Class A push-pull circuit, derive the expression. **7**
- (b)** What is the importance of transistor phase inverter? Draw the circuit diagram and describe it. **3**

OR

- Q-5 (a)** Explain the classification of push pull power amplifiers based on class of operation and compare them. **7**
- (b)** List the criteria for designing power amplifier. **3**
- Q-6** Drawing AC equivalent circuit of differential amplifier and hence derive expressions for gain of the amplifier in difference and common mode configurations. **10**

OR

- Q-6** Define and explain the following Op-Amp parameters and describe universal balancing techniques to determine such parameters: **10**
- (i) Input offset voltage (ii) PSRR and (iii) Input bias current.

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